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Request for grant of a patent

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The Patent Office

Cardiff Road
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1. Your reference

CAS 70

2. Patent application number
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0316661.8 ✓

16 JUL 2003 ✓

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

Swedish Match Lighters B.V.
A.H.G. Fokkerstraat 5
NL 9403 AM Assen
Netherlands

Patents ADP number *(if you know it)*

If the applicant is a corporate body, give the country/state of its incorporation

Incorporated in the Netherlands

78165 80001

4. Title of the invention

Child resistant actuation means for gas lighters and the like

5. Name of your agent *(if you have one)*

Hillgate Patent Services

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

6 Aztec Row
Berners Road
Islington
London
N1 0PW

Patents ADP number *(if you know it)*

0 595 311 2002

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing *(day / month / year)*

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:*

a) any applicant named in part 3 is not an inventor, or

b) there is an inventor who is not named as an applicant, or

c) any named applicant is a corporate body.

See note (d))

Yes

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9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form	
Description	32
Claim(s)	10
Abstract	1
Drawing(s)	9

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Priority documents	
Translations of priority documents	
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
Request for preliminary examination and search *(Patents Form 9/77)*	1
Request for substantive examination *(Patents Form 10/77)*	
Any other documents *(please specify)*	

11. I/We request the grant of a patent on the basis of this application.

Signature Hillgate Patent Services Date 16th July 2003

12. Name and daytime telephone number of person to contact in the United Kingdom Steve Finch (020) 7704 9997

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Notes

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Child resistant actuation means for gas lighters and the like

This invention relates to child resistant actuation means for gas lighters and other hand held devices.

It is often desirable to make it difficult for small children to actuate hand held devices, by which is meant devices which are held in the hand during use, which could otherwise cause injury or inconvenience. Gas lighters are a particularly good example. These well known hand held devices consist essentially of a small pressurized fuel gas container or reservoir, a valve which is operable to allow fuel to escape, and means, such as a piezoelectric device or a sparkwheel cooperating with a flint, for generating a spark to ignite the gas. A piezoelectric spark generating device is commonly used to ignite the gas, and benefits from simplicity, reliability and longevity in use. Common types of gas lighters include small cigarette lighters for carrying in the pocket, and utility lighters or gas lighting rods which are typically used for such purposes as igniting burners on gas cookers and lighting barbecues and camp fires.

It is well known that children are liable to play with lighters (whether cigarette lighters or utility lighters), and serious accidents can occur as a result. Lighters must therefore be designed to minimize the chance of a child being able to light them. In other words, they should be child-resistant, though perfect child-proofing is of course impossible. Ideally, an adult should be able to use the lighter easily and a child should find it impossibly difficult to use. But in practice this obviously cannot be achieved, and a lighter is regarded as child-resistant if it provides a balance between these two conflicting requirements which is as good as is reasonably feasible and which fulfils minimum child resistance criteria.

A standard for child resistance has been specified in the USA by means of a functional test by the Consumer Product Safety Commission: 16 CFR Parts 1145 and 1210, Risks of Injury Associated with Lighters That Can Be Operated by

Children; Safety Standard for Cigarette Lighters; Rules: Federal Register, Monday July 12 1993. The degree to which a lighter is child resistant may be objectively determined by applying the test described in these Rules and Regulations.

A utility lighter incorporating a child resistant safety mechanism is shown in our earlier published PCT patent application, WO 00/08387. In that utility lighter, a control button or trigger is movable generally transversely to the body of the lighter to operate the fuel valve and the piezoelectric device, and a safety button is located roughly opposite the control button. The safety button is coupled to one arm of a cranked lever which is pivoted at the point where the two arms meet; the distal end of the second arm normally engages with the control button to prevent its depression. Depressing the safety button causes that second arm to move out of engagement with the control button, which is thereby released for movement. Thus in order to release fuel and ignite it, both buttons must be operated together, which in practice it is found difficult for small children to achieve.

Similarly, US 6,318,992 and US 6,332,772 to Sung disclose utility lighters wherein a resilient leaf is arranged to block depression of the trigger, and a separate safety button on the top of the lighter must be operated in order to open the fuel valve and move the resilient leaf to the non-obstructing position. The safety button may be freely operated, liberating fuel, but the fuel will not be ignited until the trigger is depressed. Once the safety button is held in the operative position, the trigger may then be depressed to activate the piezoelectric device and ignite the fuel.

All of the above mentioned devices enjoy the advantage that the trigger or control button and the safety button are positioned roughly opposite each other so that an adult may operate them conveniently with the thumb and finger of one hand, whilst being spaced apart so that a child with smaller hands will find it more difficult to reach both buttons simultaneously.

However, it is possible that, during the working life of a gas lighter, and especially a utility lighter which has larger control elements or buttons, large forces may be applied to its operating mechanisms through careless or excessively vigorous use. Furthermore, some users may deliberately apply excessive force to a lighter in an attempt to defeat its child resistancy so as to make it easier to use. Under these circumstances it is possible that the cranked lever or the resilient leaf of the above mentioned devices may be damaged, impairing the child resistancy of the lighter and leaving it vulnerable to unintended use.

It is accordingly the aim of the present invention to provide a child resistant actuation means which can be applied to a hand held device. It is a further aim of the invention to provide in certain of its aspects a piezoelectric gas lighter which is convenient in use but provides robust child resistancy.

According to a first aspect of the present invention there is provided a piezoelectric lighter, including a casing, a reservoir containing fuel, a valve operable by a user for releasing fuel from the reservoir, a piezoelectric device for generating a spark for igniting the fuel, and at least a first control element, wherein the first control element is normally biased to a rest position and is displaceable by the user in at least a first direction to impart an actuating motion to the piezoelectric device; and further including an intermediate member for transferring the actuating motion from the first control element to the piezoelectric device, together with enabling means operable by the user to set the intermediate member from a normal, disabled condition, wherein on displacement of the first control element in the first direction, the actuating motion is not transferred to operate the piezoelectric device, to an enabled condition wherein on displacement of the first control element in the first direction, the actuating motion is transferred to operate the piezoelectric device;

characterised in that the intermediate member forms part of the first control element and includes a first engagement surface, and the piezoelectric device

includes a second engagement surface, and in use the first engagement surface engages the second engagement surface.

According to a second aspect of the invention there is provided a piezoelectric lighter, including a casing, a reservoir containing fuel, a valve operable by a user for releasing fuel from the reservoir, a piezoelectric device for generating a spark for igniting the fuel, and at least a first control element, wherein the first control element is normally biased to a rest position and is displaceable by the user in at least a first direction to impart an actuating motion to the piezoelectric device; and further including an intermediate member for transferring the actuating motion from the first control element to the piezoelectric device, together with enabling means operable by the user to set the intermediate member from a normal, disabled condition, wherein on displacement of the first control element in the first direction, the actuating motion is not transferred to operate the piezoelectric device, to an enabled condition wherein on displacement of the first control element in the first direction, the actuating motion is transferred to operate the piezoelectric device;

characterised in that the intermediate member forms part of the piezoelectric device and includes a first engagement surface, and the first control element includes a second engagement surface, and in use the second engagement surface engages the first engagement surface.

According to a third aspect of the invention there is provided a piezoelectric lighter, including a casing, a reservoir containing fuel, a valve operable by a user for releasing fuel from the reservoir, a piezoelectric device for generating a spark for igniting the fuel, and at least a first control element, wherein the first control element is normally biased to a rest position and is displaceable by the user in at least a first direction to impart an actuating motion to the piezoelectric device; and further including an intermediate member for transferring the actuating motion from the first control element to the piezoelectric device, together with enabling means operable by the user to set the intermediate member from a normal,

disabled condition, wherein on displacement of the first control element in the first direction, the actuating motion is not transferred to operate the piezoelectric device, to an enabled condition wherein on displacement of the first control element in the first direction, the actuating motion is transferred to operate the piezoelectric device;

characterised in that the intermediate member is a separate element mounted for translational movement between an enabled position and a disabled position, wherein in use, in the enabled position the intermediate member engages the first control element and the piezoelectric device, and in the disabled position the intermediate member engages neither the first control element nor the piezoelectric device.

According to a fourth aspect of the invention there is provided a piezoelectric lighter, including a casing, a reservoir containing fuel, at least a first control element, and two operating components operable by a user, the operating components comprising a valve for releasing fuel from the reservoir and a piezoelectric spark generating device for igniting the fuel, wherein the first control element is normally biased to a rest position and is displaceable by the user in at least a first direction to impart an actuating motion to at least one said operating component; and further including an intermediate member for transferring the actuating motion from the first control element to the said at least one operating component, together with enabling means operable by the user to set the intermediate member from a normal, disabled condition, wherein on displacement of the first control element in the first direction, the actuating motion is not transferred to operate the said at least one operating component, to an enabled condition wherein on displacement of the first control element in the first direction, the actuating motion is transferred to operate the said at least one operating component;

characterised in that the lighter includes at least first and second frictional engagement surfaces which are arranged so as to move past each other in the disabled condition, and the enabling means are arranged to urge the first and

second frictional engagement surfaces together in the enabled condition so as to transfer the actuating motion from the first to the second frictional engagement surface.

According to a fifth aspect of the invention there is provided a piezoelectric lighter, including a casing, a reservoir containing fuel, at least a first control element, and two operating components operable by a user, the operating components comprising a valve for releasing fuel from the reservoir and a piezoelectric spark generating device for igniting the fuel, wherein the first control element is normally biased to a rest position and is displaceable by the user in at least a first direction to impart an actuating motion to at least one said operating component; and further including an intermediate member for transferring the actuating motion from the first control element to the said at least one operating component, together with enabling means operable by the user to set the intermediate member from a normal, disabled condition, wherein on displacement of the first control element in the first direction, the actuating motion is not transferred to operate the said at least one operating component, to an enabled condition wherein on displacement of the first control element in the first direction, the actuating motion is transferred to operate the said at least one operating component;

characterised in that the intermediate member is of variable length and includes first and second ends engaging respectively the first control element and the said at least one operating component, and an intermediate section disposed between the first and second ends so as to define a variable distance of separation between the first and second ends, wherein in the disabled condition the distance of separation between the first and second ends is reducible by displacement of the intermediate section in a direction generally transverse to the direction of the actuating motion, and in the enabled condition the displacement of the intermediate section is restrained in the said generally transverse direction during movement of the intermediate member in the direction of the actuating motion.

The present invention in each of its abovementioned aspects provides a child resistant mechanism which is simple and economical in construction yet is resistant to damage and difficult to defeat. The application of excessive force to the first control element or trigger when the intermediate member is in the disabled position merely results in the abutment of the trigger against the lighter body or other components without actuation of the lighter, leaving the child resistancy of the lighter unimpaired.

Furthermore, in embodiments of the invention the user is required to apply at least a minimum amount of force simultaneously and continuously to two control elements in order to achieve ignition; the required combination of force and coordination makes it still more difficult for a small child to operate the lighter.

According to a sixth aspect of the invention there is provided a child resistant actuation means for a hand held device, the hand held device having at least one moveable component; characterised in that the actuation means comprises a volumetrically displaceable material wherein the actuation means is operable by a user of the device so as to displace the material and the moveable component is actuated by displacement of the material, when a sufficient minimum volume of the material is displaced.

Further advantages and features of the invention will become apparent from the following description, where various embodiments of the invention are described by way of illustration and with reference to the accompanying drawings, in which:

Fig. 1A is a simplified longitudinal section of a first lighter according to a first embodiment of the invention, with some components omitted for clarity, showing the control button in the rest position and the intermediate member in the disabled position;

Fig. 1B shows the first lighter with the control button in the fully depressed position and the intermediate member in the disabled position;

Fig. 1C shows the first lighter with the control button in the rest position and the intermediate member in the enabled position;

Fig. 1D shows the first lighter with the control button in the fully depressed position and the intermediate member in the enabled position;

Figs. 2A, 2B, 2C and 2D are corresponding views of a second lighter according to a second embodiment;

Fig. 3A is a simplified longitudinal section of a third lighter according to a third embodiment of the invention, again with some components omitted for clarity, showing the control button in the rest position and the intermediate member in the disabled position;

Fig. 3B is an enlarged view of the area 3B of Fig. 3A;

Fig. 3C shows the third lighter with the control button in the fully depressed position and the intermediate member in the disabled position;

Fig. 3D shows the third lighter with the control button in the rest position and the intermediate member in the enabled position;

Fig. 3E is an enlarged view of the area 3E of Fig. 3F;

Fig. 3F shows the third lighter with the control button in the fully depressed position and the intermediate member in the enabled position;

Fig. 4A is a similar longitudinal section of a fourth lighter according to a fourth embodiment of the invention, showing the control button in the rest position and the intermediate member in the disabled position;

Fig. 4B is an enlarged view of the area 4B of Fig. 4A;

Fig. 4C shows the fourth lighter with the control button in the fully depressed position and the intermediate member in the disabled position;

Fig. 4D shows the fourth lighter with the control button in the rest position and the intermediate member in the enabled position;

Fig. 4E is an enlarged view of the area 4E of Fig. 4F;

Fig. 4F shows the fourth lighter with the control button in the fully depressed position and the intermediate member in the enabled position;

Fig. 5A is a similar longitudinal section of a fifth lighter according to a fifth embodiment of the invention, showing the control button in the rest position and the intermediate member in the disabled condition;

Fig. 5B is an enlarged view of the area 5B of Fig. 5A;

Fig. 5C shows the fifth lighter with the control button in a partially depressed position and the intermediate member in the disabled condition;

Fig. 5D is an enlarged view of the area 5D of Fig. 5E;

Fig. 5E shows the fifth lighter with the control button in the fully depressed position and the intermediate member in the enabled position;

Fig. 6A is a similar longitudinal section of a sixth lighter according to a sixth embodiment of the invention, showing the control button in the rest position and the intermediate member in the disabled condition; and

Fig. 6B is an enlarged view of the area 6B of Fig. 6A.

Corresponding reference numerals are used for corresponding parts throughout.

Referring to Figs. 1A – 1D, a piezoelectric utility lighter includes a lighter body shell or casing 1, which may be moulded from plastics material and supports a barrel 2, conveniently formed from stainless steel. The body contains a reservoir of pressurised fuel such as butane or the like, which may be released from the reservoir by means of a valve, conveniently controlled by a lever which is operable by the user. The liberated gas is conducted along a tube or the like to a nozzle situated in the tip of the barrel 2, where it is ignited by a spark formed by an electrical discharge between the nozzle and the barrel, which form electrodes separated by a spark gap. Of course, separate electrodes might alternatively be provided. The discharge is generated by compression of the piezoelectric actuator 20, which is connected to the electrodes by conductors.

A first control element or trigger 30 is conveniently moulded from plastics material and is normally biased to the rest position shown in Figs. 1A and 1C by a spring 38. A resilient leaf or the like might alternatively be used as biasing means. The trigger slides reciprocally into the lighter shell when pressed inwards by the user's finger in a first direction, indicated by the arrow A; a stop surface 32 may be provided on the trigger to contact a corresponding surface 33 on the lighter body, preventing further inward movement when maximally depressed.

A resiliently biased intermediate member 40 is formed as part of the trigger, and may be formed as a resilient tab or leaf made from spring steel, plastics or other suitable material and mounted on the trigger, or alternatively moulded integrally

with the trigger from plastics material. The intermediate member is provided with a first engagement surface 42, and normally occupies a disengaged or rest position as shown in Figs. 1A and 1B, where the engagement surface 42 is out of alignment with a second engagement surface 22 formed on the piezoelectric device 20. When the trigger 30 is displaced by the user in the first direction A from the rest position (Fig. 1A) to the operated position (Fig. 1B) the intermediate member slides freely past the piezoelectric device 20 so that it does not transfer the actuating motion A to the piezoelectric device and no spark is generated. The application of further force to the trigger merely results in the abutment of the trigger against the stop surface 33, thus avoiding damage to the intermediate member. Alternatively, a separate intermediate member might be provided and attached to the trigger, for example by a hinge, together with resilient biasing means for biasing it into the disengaged position.

By forming it as part of the trigger, the intermediate member benefits from simplicity and economy of construction and provides an extremely compact mechanism which needs very little room to operate, enabling the overall size of the lighter body to be reduced and saving in materials costs.

A safety button 50 operable separately from the trigger is provided on an upper surface of the lighter body remote from the trigger. The safety button thus lies generally above and on an opposite side of the lighter from the trigger, where it cannot be operated together with the trigger by one finger, but may be conveniently operated by the thumb of an adult user whilst the trigger is operated simultaneously by a finger of the same hand. This convenient configuration is enhanced by the generally backward, longitudinal motion of the trigger and the generally downward, transverse motion of the safety button, creating a natural combination of movements for the user. At the same time, the spaced-apart configuration of the buttons makes it difficult for a child with small hands to operate both buttons together. Of course, other configurations of trigger and safety button are possible. The safety button 50 is recessed into a slight concavity 3 in

the lighter body, which makes it more difficult for a child to operate it by pressing the lighter against a surface.

The safety button 50 has a stem 52 which bears axially against the resilient leaf 40, so that the resilient leaf upwardly biases the safety button towards its rest position. The safety button 50 is located in a slot 4 in the lighter body so that it is displaceable by the user in a first, unlocking direction B; the stem 52 is resiliently deformable transversely to its longitudinal axis, and normally biases the safety button to a first, locked position as shown in Figs. 1A and 1B, in which a locking surface 53 on the lower face of the head of the button engages an upper surface 5 of the body. This prevents displacement of the safety button in a second, enabling direction C.

Separate biasing means such as a spring (not shown) may also be provided to bias the safety button to its rest position. A collar 54 may be provided to retain the safety button to the lighter body, and the separate biasing means (not shown) may be arranged between the collar 54 and a guide 6 forming part of the lighter body which slidingly retains the stem 52.

The separate biasing means (not shown) may further be arranged to increase the force required to operate the safety button and engage the intermediate member – for example by providing a relatively strong spring. This combination of features may further enhance the child resistancy of the lighter, since children will find it particularly difficult to coordinate operation of the trigger and the safety button while at the same time providing the requisite force. An adult will generally be able to supply sufficient force to the safety button by grasping the lighter body with one hand and pressing down with the thumb, leaving one finger free to operate the control button or trigger, while coordinating the combination of movements in the right order. In contrast, a child's smaller and weaker hand may often be unable to restrain the lighter body while depressing the safety button, which offers a relatively small area of contact and hence requires a concentrated

force, requiring the child to use both hands in order to supply sufficient force to the safety button. This makes it more difficult for the child to simultaneously operate the trigger 30 against the resistance of the piezoelectric device.

Rather than being depressible, the safety button might alternatively be arranged to slide or rotate on the surface of the lighter body. The stem might then be formed for example as a separate component cooperating with a ramped surface on the reverse of the safety button, or alternatively for example as a cranked lever, or a flexible or pivoted member extending from the safety button and slidingly engaging an oblique fixed surface on the lighter body, so as to exert a force generally transverse to the direction of movement of the sliding or rotating safety button. Equivalent arrangements will be readily apparent to those skilled in the art.

Returning to Figs. 1A – 1D, in order to operate the lighter, the user must first displace the safety button 50 in the unlocking direction B so as to move it to the unlocked position shown in Figs. 1C and 1D, where surfaces 5 and 53 are no longer in alignment. The stem 52 bends sideways to accommodate the movement. The safety button 50 may then be depressed in the second, enabling direction C so as to displace the intermediate member 40 to the enabled position, as shown in Fig. 1C. In the enabled position, the engagement surface 42 formed on the intermediate member abuts the second engagement surface 22 on the piezoelectric device 20. While pressing the safety button downwards C to retain the intermediate member in this position, the user may then operate the trigger 30 in the first direction A; the intermediate member then bears against the piezoelectric device and transfers the actuating motion A from the trigger so as to compress the piezoelectric device as the trigger is displaced, creating a spark which ignites the released fuel. The lower end 59 of the stem 52 of the safety button bears slidingly against the intermediate member 40 so that the intermediate member slides past it as the trigger is depressed. Alternative arrangements for engaging the safety button with the intermediate member will be apparent to those skilled in the art.

Referring to Figs. 2A – 2D, in a second embodiment a second lighter is formed similarly to the first lighter, but includes an intermediate member 60 which forms part of the piezoelectric device 20. The intermediate member is conveniently formed as a resilient leaf which has an engagement surface 62, and may be moulded integrally with the piezoelectric device 20. Alternatively it may be formed as a separate component, for example as a leaf made from steel, plastics or other suitable material and mounted on the piezoelectric device and moving together with it. A corresponding engagement surface 36 is formed on the trigger 30. The resilient leaf 60 normally occupies a disabled or rest condition as shown in Figs. 2A and 2B, where the abutting surfaces 62 and 36 are out of alignment. Alternatively the intermediate member may be hinged to the piezoelectric unit, and separate resilient biasing means provided to bias it to the disabled position. The second lighter benefits from compactness and economy of construction similar to that of the first lighter.

In the disabled position, the trigger 30 may be freely displaced by the user in a first direction A from the rest position (Fig. 2A) to the fully depressed position (Fig. 2B) without operating the lighter, since in this position the intermediate member 60 slides freely past the trigger 30 and no spark is generated.

A safety button 50 is provided with a stem 52 which bears on the resilient leaf 60 as described above with reference to the first lighter. In order to operate the lighter the user must first unlock B and depress C the safety button 50 so that the intermediate member is urged into the engaged position as shown in Fig. 2C. The engagement surfaces 62 and 36 are then brought into abutment, and the trigger 30 may be depressed A to displace the intermediate member 60 towards the piezoelectric device. The intermediate member transfers the actuating motion A from the trigger to the piezoelectric device, compressing it and generating a spark to ignite the released fuel.

For the sake of clarity not all operating components are shown. The fuel valve may be operated by the user together with the piezoelectric device by the first control element or trigger, for example by arranging a lever to cooperate with the trigger and open the valve. This brings the advantage that neither fuel release nor spark generation is achieved until the correct sequence of enabling and actuating operations has been performed. Alternatively the valve may be operated directly by the enabling means, for example by means of a lever cooperating with the safety button.

In alternative embodiments of the invention the enabling means may be integral with the trigger, by arranging for the trigger to be movable in a first, enabling direction and then in a second, actuating direction. Alternatively the safety button may be mounted on the trigger.

Referring to Figs. 3A – 3F, a third lighter includes a trigger 30 and piezoelectric device 20 as described above, but has an intermediate member 70 which is formed as a separate element which is engageable with both the trigger and the piezoelectric device, and is resiliently biased towards the disabled position by a spring 73 mounted within the trigger and slidingly engaging the lower surface of the plate.

By forming the intermediate member as a substantially flat plate 70 and mounting it for translational movement between the disabled position (Figs. 3A – 3C) and enabled position (Figs. 3D – 3F) it is possible to arrange the moving parts so as to occupy minimal volume within the lighter casing, resulting in a surprisingly compact assembly. Furthermore, since the safety button 50 is only required to move through the small range of translational movement between the two positions, it may be formed as a small component with a low profile and hence is less vulnerable to unintended operation by infants than would be a larger component with a larger range of motion. The small range of movement of the safety button thus achieved makes it particularly difficult for the infant to

appreciate the necessity of maintaining it in the fully enabled (depressed) position and to apply enough pressure to it to prevent it from rising slightly into the disabled position, especially where the required pressure is proportional to the pressure applied to the trigger as further described below.

In operation the enabling means or safety button 50 is first displaced in the unlocking B and enabling C directions so as to move the plate 70 downwards into the enabled position, where engaging surfaces 71, 72 formed on the plate engage corresponding engaging surfaces 36, 22 on the trigger and piezoelectric device. Pegs or guides (not shown) may be formed on the plate to cooperate with guiding structures formed on the lighter body 1 so as to maintain the plate in the correct orientation within the body.

The engagement surfaces may be formed as plain abutting surfaces transverse to the direction of the actuating motion A. It will be noted however that in the embodiment shown, the engaging surface 36 is angled so as to form a frictional engagement surface which urges the intermediate member 70 out of engagement when the trigger 30 is moved in the first (actuating) direction A; the remaining engagement surfaces may be similarly angled, requiring the user to apply additional force on the enabling means or safety button 50 in the enabling direction C in order to maintain the intermediate member in the enabled condition during operation of the lighter. If insufficient force is applied to the enabling means during displacement of the trigger, the engagement surfaces will thus slip past each other, allowing the trigger to be depressed without transferring the actuating motion to the piezoelectric device. In the disabled position (Figs. 3A – 3C) the intermediate member engages neither the trigger nor the piezoelectric device.

Piezoelectric spark generating devices typically comprise a stiff spring loaded hammer component which is first pre-loaded by compression of the device and then released automatically to impact on the spark generating crystal; the device is

not fired unless the full working stroke is accomplished. It will be appreciated by those skilled in the art that devices of this type require a significant amount of compressive force to pre-load and release the hammer.

It will be noted that where a frictional or clutch type engagement is employed between the intermediate member and the control element and/or the operating component of the lighter, it is necessary to maintain a sufficient force on the enabling means or safety button while the control element or trigger is operated in order to ensure sufficient frictional engagement between the friction surfaces to transfer the necessary force from the trigger to the operating component. By arranging the intermediate member to transfer motion to the piezoelectric device, the further advantage is therefore realised that a substantial amount of force must be exerted on the safety button throughout the lighting operation in order to prevent the friction surfaces from slipping past each other under the relatively heavy load placed on the trigger by the user's digit.

It is found that when children attempt to operate a lighter, they may exert erratic or transient forces on the control elements (triggers or buttons), for example by banging them or forcing them against the floor or furniture, but find it much more difficult to maintain a constant force. Furthermore, children may find it particularly difficult to maintain a constant force on two separate control elements, particularly when they are spaced apart on the casing of a utility lighter which is sufficiently large for a small child to be unable to grasp it and reach both buttons with one hand. When the force required to be applied to the enabling means is of a significant magnitude, this difficulty may become insuperable.

By arranging for the force required to be applied to the safety button to maintain the intermediate element in the enabled position to be proportionately large in relation to the force required to be applied to the trigger, and by requiring the force to be applied constantly and simultaneously to both the trigger and the safety button, embodiments of the invention thus enjoy a particularly high degree

of child resistancy. This is conveniently accomplished as described by arranging the intermediate member to transfer motion to the piezoelectric device, requiring a substantial force to be exerted on the trigger, while forming the engagement surfaces so that they can slip past each other under the actuating load from the trigger.

It will be noted that in all of the abovedescribed embodiments, if the trigger 30 is displaced in the first direction A without first depressing the safety button in the enabling direction C, the engaging surfaces will move out of alignment and the intermediate member will lie adjacent the trigger or piezoelectric device. This prevents operation of the enabling means until the trigger is returned to its rest position. The abovedescribed embodiments thus benefit in that the enabling means and the trigger must be operated in the correct sequence in order to actuate the lighter. In addition, although the safety button 50 may be formed without locking means, it is preferably formed as described above so that the correct sequence of unlocking B, enabling C and actuating A motions must be followed in order to achieve ignition.

Referring to Figs. 4A – 4F, a fourth lighter is formed similarly to the second lighter with a trigger 30 for imparting an actuating motion to a piezoelectric device 20 via an intermediate member 60 which forms part of the piezoelectric device. In this embodiment the intermediate member 60 has a frictional engagement surface 63 which in the enabled condition (Figs. 4D – 4F) is urged into engagement with a corresponding frictional engagement surface 37 formed on the trigger, by unlocking B and then depressing C the safety button as described with reference to the second lighter. The actuating motion A of the trigger 30 may then be transferred through the frictional engagement surfaces to the piezoelectric device 20. The lower end 59 of the stem 52 of the enabling means bears axially and slidingly on the smooth upper surface of the intermediate member 60 so that the intermediate member can slide past it in operation.

Similarly to the foregoing embodiments, the trigger has a stop surface 32 which abuts a corresponding stop surface 33 on the lighter body to define the maximum limit of travel of the trigger in the first direction A. The separation between these two surfaces defines a maximum distance of displacement M of the trigger in the first direction, which in turn defines the maximum length of the actuating stroke which may be imparted to the piezoelectric device before the trigger abuts the body.

Desirably, the piezoelectric device 20 (and/or, where the intermediate member is arranged alternatively or additionally to act on the valve mechanism, the lever or other valve control means) is arranged so as to be inoperable by means of an actuating stroke substantially shorter than the distance M. In practice the actuating stroke required will be an inherent characteristic of the operating component in question, whether the piezoelectric device or the valve, so the positioning of the stop surfaces may conveniently be adjusted to suit.

The two frictional engagement surfaces 37, 63 are formed generally in parallel with the direction A of the actuating motion, so that in the disabled position (Figs. 4A – 4C) they slip past each other when the trigger is depressed, as shown in Fig. 4C. The surface 37 on the trigger is extended so that the surface 63 on the intermediate member may engage it at any point along its length. This enables the trigger to be partially depressed in the first direction A before depression of the safety button in the enabling direction C engages the intermediate member with the trigger. Similarly, where the force applied to the safety button 50 in the enabling direction C during operation of the trigger is reduced below the minimum necessary to maintain frictional engagement between the two engagement surfaces, the surfaces will move or slip partially past each other.

When the trigger is in the rest position it is separated from the piezoelectric device by a defined distance. Any slippage between the frictional engagement surfaces 37, 63 during depression of the trigger, or any depression of the trigger prior to

engagement, will result in a reduction in this defined distance, which reduces the maximum length of the actuating motion transferred to the piezoelectric device to a value less that the maximum distance of displacement of the trigger M and less than the triggering distance of the piezoelectric device.

The distance of separation between the two components during operation of the lighter is thus proportional to the force applied to the safety button 50 by the user. As described above, the minimum enabling force for maintaining engagement between the two engagement surfaces will depend inter alia on the frictional characteristics and areal extent of the engagement surfaces, and the stiffness of the piezoelectric device; it may also be enhanced by additional springs acting between the lighter body and either or both of the trigger and the safety button. Although the frictional engagement surfaces are shown by way of illustration with visible teeth, in practice they might be formed for example from plastics or rubber material having a smooth or roughened surface with the required frictional characteristics.

The piezoelectric device is preferably selected so as to be inoperable by any stroke substantially shorter than M, ensuring that any reduction of the force applied to the safety button 50 below the minimum enabling force renders the lighter inoperable until the trigger is returned to the rest position and the safety button 50 is released, and force reapplied in the enabling direction C. The interaction of these components makes it still more difficult for an infant to understand the operational requirements of the lighter, and to apply sufficient force to both control elements 30 and 50 simultaneously and continuously, and so achieve ignition of the lighter.

It will be appreciated that the intermediate member of the fourth lighter need not form part of the piezoelectric device; for example, it might alternatively be arranged on the trigger or as a separate element cooperating with both the trigger

and the piezoelectric device and having separate frictional engagement surfaces for engaging one or both components.

The enabling force may be applied via a small safety button as shown, which makes it particularly difficult for small children to operate the lighter. Alternatively a larger, perhaps pivoted or flexible handgrip area may be formed on the casing of the lighter so that the pressure of the user's hand on the handgrip is transferred to the intermediate element to set it to the enabled condition; the handgrip may be biased by a strong spring or the like, requiring a minimum enabling force which corresponds to the normal minimum grip strength of the average adult user. The user must therefore maintain their grip on the lighter throughout the process of depression of the trigger.

Alternatively the trigger 30 may be arranged for movement in a first, enabling direction – for example, for upward translation into the body of the lighter, or rotational movement – which forces the intermediate member against a sliding surface formed on the lighter body and so sets it in the enabled condition, before the trigger is depressed in a second, actuating direction A. Thus pressure must be maintained in the first, enabling direction whilst depressing the trigger to achieve ignition. Similar arrangements may be applied to the fifth lighter described below.

Referring to Figs. 5A – 5E, a fifth lighter includes a first control means or trigger 30 and enabling means formed as a second control means or safety button 50, together with a piezoelectric device 20 similar to the previously described embodiments. The trigger is normally biased towards the rest position as shown in Figs. 5A and 5B by means of a spring 38. The safety button is shown without locking means, although it may alternatively include locking means as described above, and is operable to enable the intermediate member by depressing it downwards in the direction C as shown in Figs. 5D and 5E. It is biased upwardly towards the rest position by a spring 51. An enlarged sliding surface 58 is formed on the lower end of the stem 52.

As described with reference to the fourth lighter, stop surfaces 32, 33 formed respectively on the trigger and on the lighter body define a maximum distance of displacement M of the trigger in the first direction A, which in turn determines the maximum length of stroke of the actuating motion which can be imparted by the trigger 30 to the piezoelectric device 20.

The intermediate member 80 includes an intermediate section comprising two arms 81, 82 which are joined together by a pivoting joint 83. The ends 84, 85 of the intermediate member are attached respectively to the trigger 30 and to the piezoelectric device 20 by further pivoting joints; alternatively they might engage in sockets or the like which permit pivoting movement, or they may be formed as integral resilient elements. The trigger and the piezoelectric element are separated by a variable distance defined by the variable length of the intermediate section of the intermediate element between its two ends 84, 85, which is to say, the distance in a straight line between the two ends 84, 85 which varies with the progressive outward or transverse displacement of the intermediate section as further described below.

In the rest condition (Figs. 5A, 5B) the intermediate element is fully extended so that the arms 81, 82 lie as shown generally in parallel with the first or actuating direction A of the trigger, but with the intermediate section sloping slightly towards the enabling means on either side of the pivot 83.

In the disabled condition the safety button 50 remains in its rest position as shown in Figs. 5A – 5C, so that the intermediate section of the intermediate element 80 may be freely displaced in a direction D generally transverse to the direction A of the actuating motion by depression of the trigger, as shown in Fig. 5C. This displacement of the intermediate section causes the two ends 84, 85 to approach each other, shortening the distance of separation between the trigger 30 and the

piezoelectric device 20, so that no actuating motion is transferred to the piezoelectric device and ignition is not achieved.

In order to operate the lighter the safety button 50 is first depressed in the enabling direction C , with the intermediate member in the rest position shown in Figs. 5A and 5B, so that the surface 58 bears slidingly on the pivot 83. This sets the intermediate member in the enabled condition. The trigger 30 is then depressed in the first direction A while the safety button 50 is maintained in the fully depressed position, whereon the intermediate section of the intermediate element 80 slides along the surface 58, which restrains the intermediate section from transverse displacement in the direction D (Figs. 5D, 5E.) This maintains the maximum extension of the intermediate element and hence the distance of separation between the trigger and the piezoelectric device, enabling the intermediate element to transfer the actuating motion A from the trigger to the piezoelectric device and thus to achieve ignition.

As described above with reference to the fourth lighter, the distance of separation between the trigger and the piezoelectric device is thus proportional to the force applied to the safety button. The piezoelectric device is preferably arranged so as to be inoperable by an actuating stroke shorter than the maximum trigger stroke M, ensuring that successful operation of the lighter is dependent on a sufficient force being continuously maintained on the safety button during depression of the trigger.

In alternative embodiments the intermediate element is formed as a resilient element without a central joint which can bend outwardly in its midsection under axial compression. It may be moulded integrally with the trigger or the piezoelectric device and engage the other component with its distal end, for example by means of a socket. Additional pivoting joints may be provided.

In the abovedescribed embodiments the intermediate member is arranged to transfer the actuating motion to the piezoelectric device. In alternative embodiments however the intermediate member may be arranged to transfer the actuating motion to the valve mechanism; in a pocket sized cigarette lighter for example, a first control element or control button may be arranged to act directly on the piezoelectric device, and a separate or integral enabling or safety button arranged to displace the intermediate member into a position wherein it will frictionally engage the valve mechanism or control button on depression of the control button.

Referring to Figs. 6A and 6B, in a further embodiment in accordance with a further aspect of the invention, a sixth hand held lighter includes a moveable intermediate element 70 which is operable by actuation means comprising a second control element arranged as an expansible vessel 90 and communicating with a compressible vessel 92. The vessels 90 and 92 are filled with a volumetrically displaceable material such as a gel or fluid 91. The compressible vessel 92 has an actuation surface 93 which is preferably formed as a flexible membrane or outer wall and arranged to form part of the outer surface of the lighter so that it is manipulable by the user. The membrane is preferably elastic but may be inelastic, and may be smooth or textured. Conveniently, the membrane may form part of a flexible bladder which is partly enclosed within the lighter casing and completely surrounds the gel; alternatively it may be sealed at its edges to the lighter casing so as to form together therewith a fluid tight compartment.

In order to actuate or enable the intermediate element 70 the user squeezes the wall 93 sufficiently to force a sufficient minimum volume of the gel 91 into the vessel 90; this displacement of the gel expands the vessel 90 so that its lower surface 94 bears slidingly on the intermediate member 70 and urges it into the enabled position as described above. The two vessels may be formed or considered as parts of a single vessel.

The moving component 70 is only actuated to the enabled condition by displacement of at least the sufficient minimum volume of gel; this may correspond to the minimum volume which may be displaced in normal use of the device by an average adult user.

In the embodiment shown, the user would typically grasp the lighter in one hand so that the palm and/or fingers embrace the actuation surface 93. The use of gel which is displaced by the user's hand grasping a deformable membrane 93 on the outer surface of the lighter body offers the advantage that the surface area of the user's hand, which reliably reflects the size and hence the age of the user, as well as the strength of the user's hand determines the amount of gel that can be displaced and hence the magnitude of the force or enabling stroke that can be applied to the operating components of the lighter. Thus displacement of sufficient gel to actuate the moving component requires compression of at least a minimum surface area of the outer wall 93. This may be adjusted by empirical tests to correspond to the minimum surface area covered in normal use by one hand of an average adult user, making it very difficult for a child to achieve displacement of the necessary defined minimum volume of gel.

When a small child attempts to operate the lighter of this embodiment, the child's hand will cover less than this minimum defined surface area, so that the gel is merely displaced around the child's small hand by bulging the free area of the membrane 93 outwardly between and around the child's fingers. In order to successfully operate the lighter, the adult user is required to cover a substantial part of the membrane with his palm or fingers so that the gel is forced inwardly towards the vessel 90. The magnitude of the force or enabling stroke required to achieve operation of the lighter is adjusted to reflect the different values achievable by adults and children.

Alternatively or additionally, the moving component 70 is only actuated by displacement of at least a sufficient minimum volume of gel, wherein the

sufficient minimum volume corresponds to the minimum actuation force which may be applied to the actuation means in normal use of the device by an average adult user. Thus a child who is unable to apply as much force as an average adult user would be unable to achieve ignition.

In the embodiment shown, the volumetrically displaceable material is preferably a noncompressible fluid such as a gel or a liquid. Alternatively however it may be a gas, and the minimum volumetric displacement and actuation force which the user is required to apply to the actuation surface may be determined in part by the resulting compression of the gas within the vessel. It will be understood of course that the sufficient minimum volume of material which must be displaced by the user in order to actuate the moving component 70, and the minimum actuation force which the user must apply to the actuation means in order to displace this minimum volume of material, are of course interrelated and, where the volumetrically displaceable material is a gas, are related to the pressure and compression of the gas, and references herein to volumes and forces are to be construed accordingly.

In alternative embodiments, the volumetrically displaceable material may be a plastically deformable material, such as a modified elastomer, so that the surface of the volumetrically displaceable material itself forms an actuation surface and no separate membrane or containing bladder is required.

The embodiment shown in Figs. 6A – 6B includes a spring 73 which applies a biasing force which normally resiliently biases the moving component 70 to its disabled or rest position. In this embodiment the minimum actuation force which the user must apply to the actuation surface 93 is determined at least in part by the biasing force exerted against the moving component 70 by the spring 73. By increasing the force of the spring it is therefore possible to increase the minimum actuation force that the user must exert, making it more difficult to operate the lighter and thus modifying its child resistant characteristics.

It will be appreciated that in alternative embodiments separate biasing means for returning the moving component of the device need not be included; for example, the actuation surface may itself comprise a resilient membrane which tends to return the moving component to the rest position by negative pressure of the displaceable material following release of the actuation surface by the user.

The minimum actuation force which the user is required to apply may also be dependent on the ratio of the area over which the actuation force is applied by the user to the volumetrically displaceable material, to the area over which the volumetrically displaceable material communicates the actuation force to the moving component, forming a type of hydraulic system which divides or multiplies the effort of the user, and the biasing force of the spring 73 and the other forces and components involved are selected accordingly.

The inner wall 95 of the vessel 92 may be relatively close to the outer surface of the lighter so that in use the membrane 93 is pressed against it, assisting the user to displace the gel 91 and relieving excess pressure within the vessel. Alternatively the inner wall 95 may be relatively distant from the membrane 93 and the outer surface of the lighter, defining a relatively deep compartment 92 which contains the gel and making it more difficult for the user to contact the compartment bottom 95.

In alternative embodiments the actuation surface need not necessarily comprise a flexible membrane. Thus for example the gel or fluid might be contained within a vessel provided with a plunger or piston which is displaced by the user by means of pressure against a flap or handle, or even by pulling on a tension element such as a lever, ring or the like.

In the embodiment shown in Figs. 6A – 6B, the user is required to apply a constant sufficient pressure to a sufficiently large surface area of the actuation

surface 93 whilst simultaneously depressing the control element or trigger 30 in order to actuate the lighter. As already described with reference to earlier embodiments, it is particularly difficult for a small child to coordinate both actions at the same time, and the use of a volumetrically displaceable material as described provides a relatively complex and subtle combination of conditions which must be fulfilled in order to achieve ignition. This combination of requirements presents a severe practical difficulty for a small child attempting to operate the lighter whilst imposing little additional difficulty for the adult user, who must merely grasp the lighter firmly in the usual way in order for his or her larger hand to naturally operate the actuation means.

In addition, the combination of minimum pressure and minimum volumetric displacement is particularly difficult for a small child to understand, and this embodiment of the invention thus provides the additional benefit that even by observing the repeated operation of the lighter by an adult, a small child will find it difficult or impossible to understand the key requirements for successful operation.

These advantages may be enhanced still further by arranging the intermediate element 70 as described above with reference to earlier embodiments as a clutch or friction member. The clutch or friction member frictionally engages the control element 30 and the piezoelectric device 20, fuel release lever, spark generating device or other moving component of the lighter. This ensures that any diminution in the applied pressure or volumetric displacement during operation of the control element will prevent successful ignition; to a small child however the lighter will appear to function as expected and the reason for its failure to ignite will not be evident. This discourages the child from playing with it further.

In the embodiment of Figs. 6A and 6B, the volumetrically displaceable material is arranged to act on an intermediate member of a gas lighter as described above with reference to earlier embodiments. Alternatively however the volumetrically

displaceable material may directly actuate any moving component of a lighter, such as for example a piezoelectric spark generating device, a wheel assembly of a lighter having a flint-and-sparkwheel ignition system, a lever or other means for controlling a fuel release valve, or any other component which controls the use of the lighter. In its present aspect the invention is thus applicable to gas lighters of all descriptions and including all types of ignition system, including cigarette lighters and utility or barbecue lighters.

Although the lighter of Figs. 6A and 6B is equipped with a control element or trigger 30 which is selectively rendered operable or inoperable by means of an intermediate element which is enabled or disabled by means of the volumetrically displaceable material, in other embodiments the intermediate element and even the control element or trigger need not be provided. Thus the lighter may be operated either partly or solely by the volumetrically displaceable material.

For example, the volumetrically displaceable material may operate one moving component of the lighter, such as the fuel release valve or the ignition means, and a control element or trigger the other; in this way it is not necessary for the volumetrically displaceable material to cooperate with the control element, since the lighter cannot be actuated without the correct operation of both components.

Alternatively for example, the actuation means may comprise a volumetrically displaceable material, such as a fluid within a vessel, which when the fluid is displaced by the user bears on a lever which opens the gas supply valve, and simultaneously depresses a piezoelectric device or alternatively rotates a sparkwheel against a flint, for example by axially displacing a rod to operate a rack and pinion assembly or by acting on the distal end of a radial extension of the wheel assembly. Alternatively for example a flat abrasive blade may be moved by the displaced fluid against a flint in order to ignite the released fuel.

In alternative embodiments the actuation surface of the volumetrically displaceable material may be arranged to form most or even all of the grippable external surface of the lighter or other hand held device; for instance, it may be shaped so as to form a contoured handle which must be gripped by the user with a minimum force over a certain minimum surface area in order to achieve actuation.

Alternatively, two or more distinct actuation surfaces may be provided, which may each communicate with the same mass of volumetrically displaceable material, or alternatively with separate masses of volumetrically displaceable material. Both surfaces must then be gripped by the user so as to displace a sufficient minimum volume of the mass or masses of material, either sequentially or simultaneously, in order to achieve ignition. The actuation surfaces may be spaced apart on the outer casing of the lighter so as to make it difficult for a child's small hand to reach both surfaces together.

For instance, one actuation surface may be arranged to actuate the lever and the other, the ignition mechanism of a gas lighter; both must be gripped simultaneously with sufficient force and over a sufficient surface area in order to achieve ignition.

Alternatively an intermediate member may be provided, in which case one actuation surface may be arranged to enable the intermediate member and the other to impart an actuating motion via the intermediate member to the fuel release valve and/or the ignition mechanism. In the latter case, the intermediate member may be arranged as set out above with reference to the earlier embodiments so that the first actuation surface must be operated before the second in order to achieve ignition. A frictional engaging surface may also be provided, similarly to the embodiment of Figs. 4, so that the minimum sufficient actuation pressure must be maintained on the first (enabling) actuation surface throughout the ignition procedure in order to allow the actuation pressure to be transferred from the second actuation surface or first control element to the operating

component or components of the lighter. Similar arrangements may be applied to other hand held devices.

Numerous alternative arrangements by which a gas lighter may be actuated by the volumetrically displaceable material according to the present aspect of the invention will be readily conceived by those skilled in the art, and it is to be understood therefore that the embodiment of Figs. 6A and 6B is merely set forth by way of example, and that all such alternative arrangements may be practised within the scope of the appended claims.

Similarly, the volumetrically displaceable material may be employed to engage a safety interlock or the like which forms part of any other hand held device, or even to directly actuate any moving component, such as a mechanical control or an electrical contact, of a hand held device.

For example, retractable craft knives and the like comprise a sharp blade which is retracted into a handle for safety and can be extended by means of a button or the like. It is therefore desirable to prevent small children from deploying the blade and injuring themselves. Thus a craft knife with a retractable blade may be provided with a safety interlock which prevents deployment of the blade until the interlock is actuated; a volumetrically displaceable material is arranged to form part of the outer casing of the knife, so that sufficient compression of the material actuates the interlock and releases the blade or the button which extends the blade.

Electrical remote control units, such as for example wireless controls for winches, and power tools such as drills and the like may similarly cause accidents or injury if operated by small children. These and other hand held devices may similarly be provided with a volumetrically displaceable material arranged to form part of the outer surface of the device which when displaced bears pressingly on a moving component, such as a spring biased electrical contact, which actuates or enables actuation of the device. Many other examples will readily be conceived, and it is

to be understood therefore that the present aspect of the invention may be applied to any hand held device within the scope of the appended claims.

In summary, embodiments of the invention may comprise a child resistant piezoelectric gas lighter which includes an intermediate member and a safety button which is operable to set the intermediate member from a disabled condition, wherein the trigger is depressible without actuating the piezoelectric spark generator, to an enabled condition wherein the intermediate member transmits the actuating motion from the trigger to the piezoelectric device to generate a spark and operate the lighter. The intermediate member may be a resilient leaf forming part of the trigger or piezoelectric device or may be a separate element engaging both components. The intermediate member may engage one or both components frictionally so that insufficient pressure on the safety button results in slippage of the intermediate member and reduces the length of the actuating stroke transmitted to the piezoelectric device or fuel valve, preventing operation of the lighter. Alternatively the intermediate member includes a flexible middle section which is sidewardly restrained by the safety button. A further aspect of the invention provides a body of displaceable material such as a gel filled vessel with a flexible actuation surface arranged on the casing of a gas lighter or any other hand held device. The vessel is manipulable by the user to displace the gel so as to actuate an intermediate member or other moving component of the device.

The embodiments illustrated are not exhaustive, and many adaptations and developments may be made thereto without departing from the scope of the claims.

CLAIMS

1. A piezoelectric lighter, including a casing, a reservoir containing fuel, a valve operable by a user for releasing fuel from the reservoir, a piezoelectric device for generating a spark for igniting the fuel, and at least a first control element,

wherein the first control element is normally biased to a rest position and is displaceable by the user in at least a first direction to impart an actuating motion to the piezoelectric device;

and further including an intermediate member for transferring the actuating motion from the first control element to the piezoelectric device,

together with enabling means operable by the user to set the intermediate member from a normal, disabled condition, wherein on displacement of the first control element in the first direction, the actuating motion is not transferred to operate the piezoelectric device,

to an enabled condition wherein on displacement of the first control element in the first direction, the actuating motion is transferred to operate the piezoelectric device;

characterised in that the intermediate member forms part of the first control element and includes a first engagement surface, and the piezoelectric device includes a second engagement surface,

and in use the first engagement surface engages the second engagement surface.

2. A piezoelectric lighter, including a casing, a reservoir containing fuel, a valve operable by a user for releasing fuel from the reservoir, a piezoelectric device for generating a spark for igniting the fuel, and at least a first control element,

wherein the first control element is normally biased to a rest position and is displaceable by the user in at least a first direction to impart an actuating motion to the piezoelectric device;

and further including an intermediate member for transferring the actuating motion from the first control element to the piezoelectric device,

together with enabling means operable by the user to set the intermediate member from a normal, disabled condition, wherein on displacement of the first control element in the first direction, the actuating motion is not transferred to operate the piezoelectric device,

to an enabled condition wherein on displacement of the first control element in the first direction, the actuating motion is transferred to operate the piezoelectric device;

characterised in that the intermediate member forms part of the piezoelectric device and includes a first engagement surface, and the first control element includes a second engagement surface,

and in use the second engagement surface engages the first engagement surface.

3. A piezoelectric lighter according to claim 1, characterised in that the intermediate member is formed as a resilient leaf.

4. A piezoelectric lighter according to claim 2, characterised in that the intermediate member is formed as a resilient leaf.

5. A piezoelectric lighter, including a casing, a reservoir containing fuel, a valve operable by a user for releasing fuel from the reservoir, a piezoelectric device for generating a spark for igniting the fuel, and at least a first control element,

wherein the first control element is normally biased to a rest position and is displaceable by the user in at least a first direction to impart an actuating motion to the piezoelectric device;

and further including an intermediate member for transferring the actuating motion from the first control element to the piezoelectric device,

together with enabling means operable by the user to set the intermediate member from a normal, disabled condition, wherein on displacement of the first control element in the first direction, the actuating motion is not transferred to operate the piezoelectric device,

to an enabled condition wherein on displacement of the first control element in the first direction, the actuating motion is transferred to operate the piezoelectric device;

characterised in that the intermediate member is a separate element mounted for translational movement between an enabled position and a disabled position,

wherein in use, in the enabled position the intermediate member engages the first control element and the piezoelectric device,

and in the disabled position the intermediate member engages neither the first control element nor the piezoelectric device.

6. A piezoelectric lighter according to any preceding claim, characterised in that the enabling means is operable when the first control element is in the rest

position but inoperable when the first control element is displaced in the first direction.

7. A piezoelectric lighter, including a casing, a reservoir containing fuel, at least a first control element, and two operating components operable by a user,

the operating components comprising a valve for releasing fuel from the reservoir and a piezoelectric spark generating device for igniting the fuel,

wherein the first control element is normally biased to a rest position and is displaceable by the user in at least a first direction to impart an actuating motion to at least one said operating component;

and further including an intermediate member for transferring the actuating motion from the first control element to the said at least one operating component,

together with enabling means operable by the user to set the intermediate member from a normal, disabled condition, wherein on displacement of the first control element in the first direction, the actuating motion is not transferred to operate the said at least one operating component,

to an enabled condition wherein on displacement of the first control element in the first direction, the actuating motion is transferred to operate the said at least one operating component;

characterised in that the lighter includes at least first and second frictional engagement surfaces which are arranged so as to move past each other in the disabled condition,

and the enabling means are arranged to urge the first and second frictional engagement surfaces together in the enabled condition so as to transfer the actuating motion from the first to the second frictional engagement surface.

8. A piezoelectric lighter, including a casing, a reservoir containing fuel, at least a first control element, and two operating components operable by a user,

the operating components comprising a valve for releasing fuel from the reservoir and a piezoelectric spark generating device for igniting the fuel,

wherein the first control element is normally biased to a rest position and is displaceable by the user in at least a first direction to impart an actuating motion to at least one said operating component;

and further including an intermediate member for transferring the actuating motion from the first control element to the said at least one operating component,

together with enabling means operable by the user to set the intermediate member from a normal, disabled condition, wherein on displacement of the first control element in the first direction, the actuating motion is not transferred to operate the said at least one operating component,

to an enabled condition wherein on displacement of the first control element in the first direction, the actuating motion is transferred to operate the said at least one operating component;

characterised in that the intermediate member is of variable length and includes first and second ends engaging respectively the first control element and the said at least one operating component,

and an intermediate section disposed between the first and second ends so as to define a variable distance of separation between the first and second ends,

wherein in the disabled condition the distance of separation between the first and second ends is reducible by displacement of the intermediate section in a direction generally transverse to the direction of the actuating motion,

and in the enabled condition the displacement of the intermediate section is restrained in the said generally transverse direction during movement of the intermediate member in the direction of the actuating motion.

9. A piezoelectric lighter according to claim 8, characterised in that the first and second ends are pivotably attached respectively to the first control element and to the said at least one operating component,

and the intermediate section includes a pivotable joint.

10. A piezoelectric lighter according to any of claims 7, 8 or 9, characterised in that stop means are provided for limiting movement of the first control element in the first direction so as to define a maximum distance (M) of displacement thereof;

and further characterised in that the said at least one operating component is inoperable by an actuating motion substantially shorter than the maximum distance (M) of displacement of the first control element;

wherein during operation of the first control element, the distance between the first control element and the said at least one operating component is proportional to a force applied to the enabling means by the user, such that when insufficient force is applied to the enabling means the said at least one operating component is not actuated.

11. A piezoelectric lighter according to any preceding claim, characterised in that the enabling means bears slidingly on the intermediate member.

12. A piezoelectric lighter according to any preceding claim, characterised in that the enabling means comprises a second control element separate from the first control element, and the first and second control elements are spaced apart such that they cannot be operated together by a single digit of a user.

13. A piezoelectric lighter according to claim 12, characterised in that the first and second control elements are operable together by a thumb and a finger of one hand of a user.

14. A piezoelectric lighter according to claim 12 or claim 13, characterised in that the second control element is normally biased to a first, locked position wherein it is inoperable by the user to set the intermediate member to the enabled condition,

and is displaceable by the user in an unlocking direction to a second, unlocked position wherein it is displaceable by the user in a further, enabling direction to set the intermediate member to the enabled condition.

15. A piezoelectric lighter according to any of claims 12 – 14, characterised in that the second control element includes an expansible vessel filled with a gel or liquid, and the gel or liquid is displaceable by the user to set the intermediate member to the enabled condition.

16. A piezoelectric lighter according to claim 15, characterised in that the gel or liquid communicates with a compressible vessel,

the compressible vessel having a surface arranged on an outer surface of the lighter and accessible by the user,

wherein displacement of sufficient gel or liquid to set the intermediate member to the enabled condition requires compression of at least a minimum surface area of the surface of the compressible vessel corresponding to the minimum surface area covered in normal use by one hand of an average adult user.

17. A piezoelectric lighter substantially as described herein with reference to the accompanying description and drawings.

18. A child resistant actuation means for a hand held device,
the hand held device having at least one moveable component;

characterised in that the actuation means comprises a volumetrically displaceable material

wherein the actuation means is operable by a user of the device so as to displace the material

and the moveable component is actuated by displacement of the material, when a sufficient minimum volume of the material is displaced.

19. A child resistant actuation means according to claim 18, characterised in that the device has an outer surface

and the actuation means includes an actuation surface forming part of the outer surface of the device.

20. A child resistant actuation means according to claim 19, characterised in that the actuation surface comprises a flexible membrane.

21. A child resistant actuation means according to any of claims 18 – 20, characterised in that the moving component is not actuated by a displacement of less than the sufficient minimum volume of displaceable material,

wherein the sufficient minimum volume corresponds to a minimum volume of displaceable material which is displaceable in normal use of the device by an average adult user.

22. A child resistant actuation means according to any of claims 18 – 21, characterised in that the moving component is not actuated by a displacement of less than the sufficient minimum volume of displaceable material,

wherein the sufficient minimum volume corresponds to a minimum actuation force which may be applied to the actuation means in normal use of the device by an average adult user.

23. A child resistant actuation means according to claim 22, characterised in that means are provided for applying a biasing force to resiliently bias the moving component to a rest position,

and the minimum actuation force is determined at least in part by the biasing force.

24. A child resistant actuation means according to any of claims 18 – 23, characterised in that the displaceable material comprises a fluid.

25. A child resistant actuation means according to any of claims 18 – 23, characterised in that the displaceable material comprises a gel.

26. A child resistant actuation means according to any of claims 18 – 25, characterised in that the device is a gas lighter.

27. A child resistant actuation means substantially as described herein with reference to the accompanying description and drawings.

ABSTRACT

Child resistant actuation means for gas lighters and the like

A child resistant piezoelectric gas lighter includes an intermediate member and a safety button which is operable to set the intermediate member from a disabled condition, wherein the trigger is depressible without actuating the piezoelectric spark generator, to an enabled condition wherein the intermediate member transmits the actuating motion from the trigger to the piezoelectric device to generate a spark and operate the lighter. The intermediate member may be a resilient leaf forming part of the trigger or piezoelectric device or may be a separate element engaging both components. The intermediate member may engage one or both components frictionally so that insufficient pressure on the safety button results in slippage of the intermediate member and reduces the length of the actuating stroke transmitted to the piezoelectric device or fuel valve, preventing operation of the lighter. Alternatively the intermediate member includes a flexible middle section which is sidewardly restrained by the safety button. A further aspect of the invention provides a body of displaceable material such as a gel filled vessel with a flexible actuation surface arranged on the casing of a gas lighter or any other hand held device. The vessel is manipulable by the user to displace the gel so as to actuate an intermediate member or other moving component of the device.

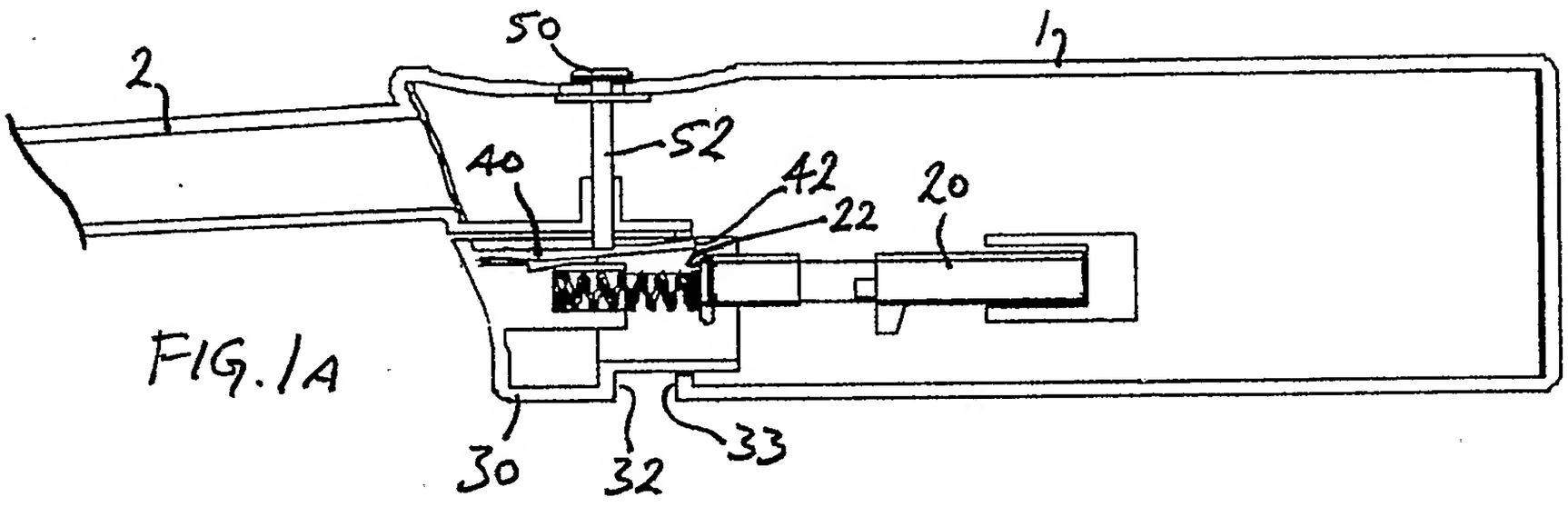

FIG. 1A

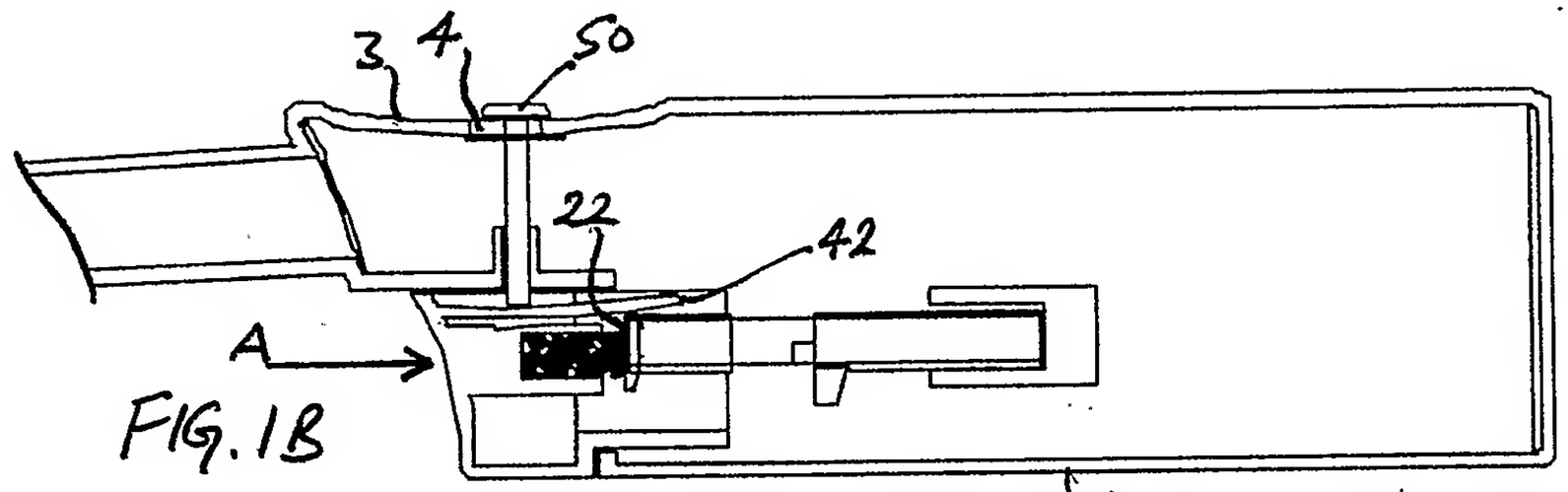

FIG. 1B

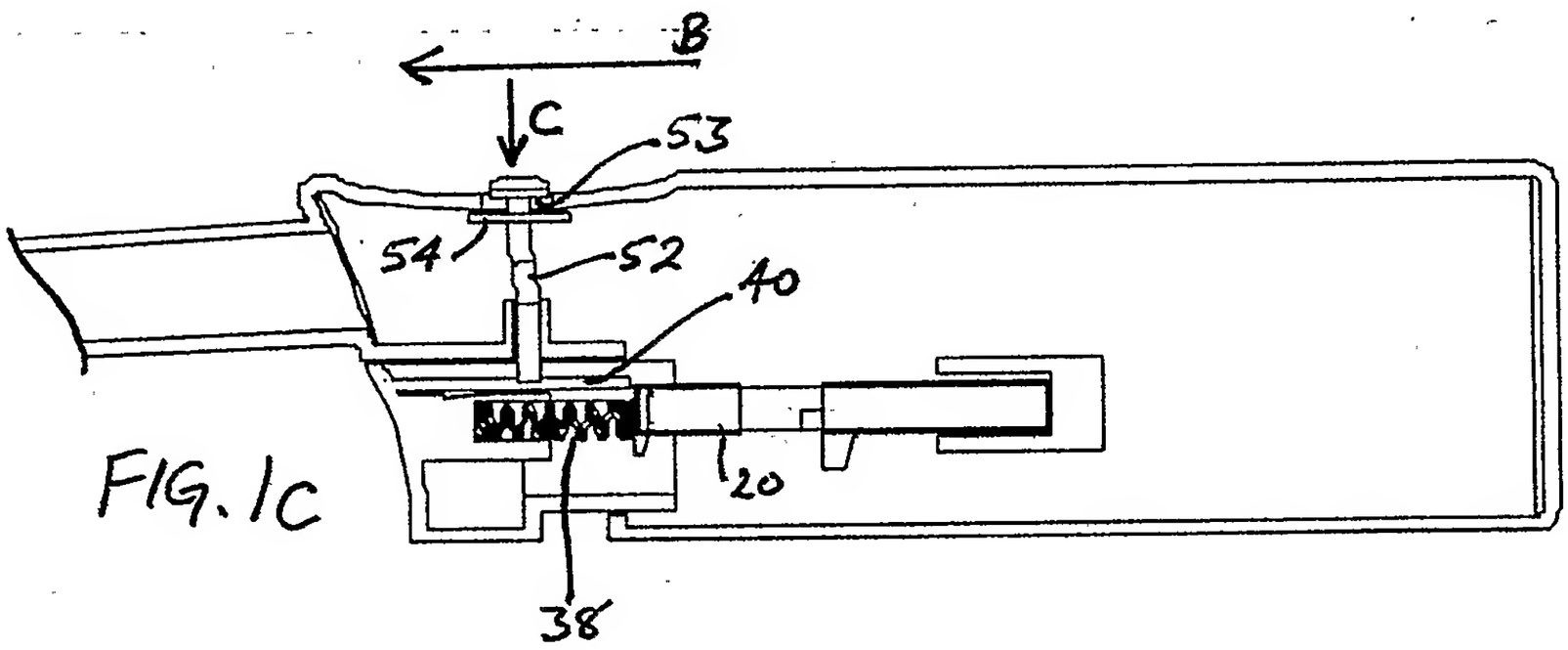

FIG. 1C

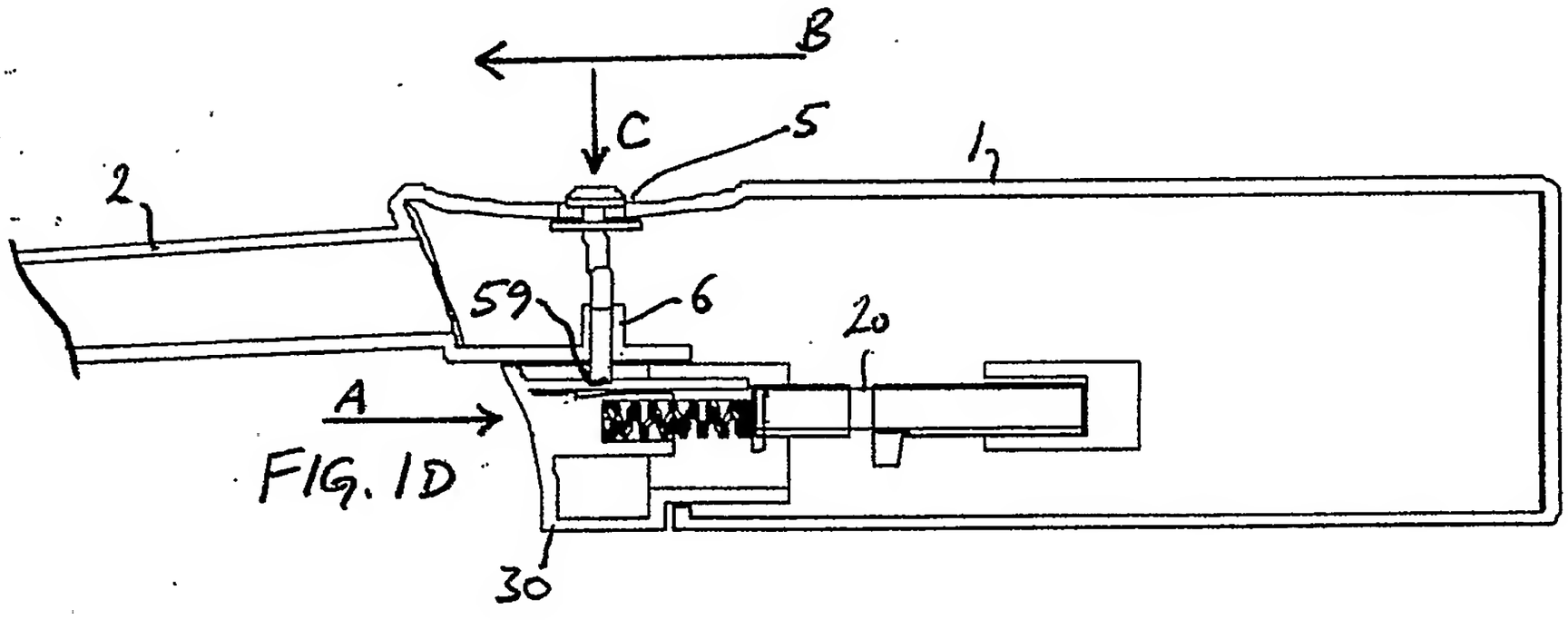

FIG. 1D

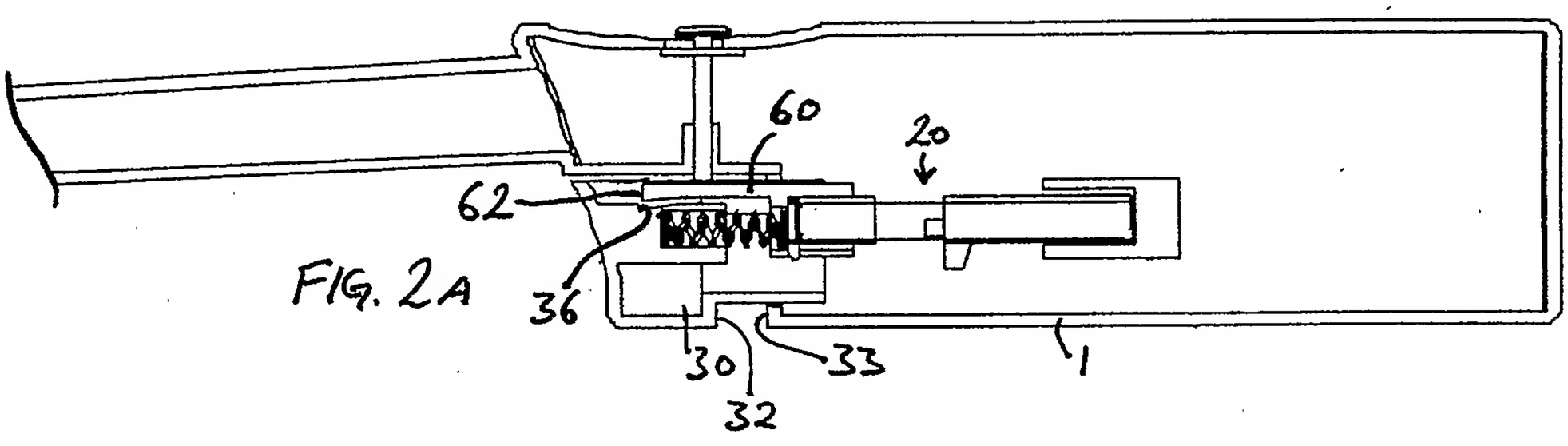

FIG. 2A

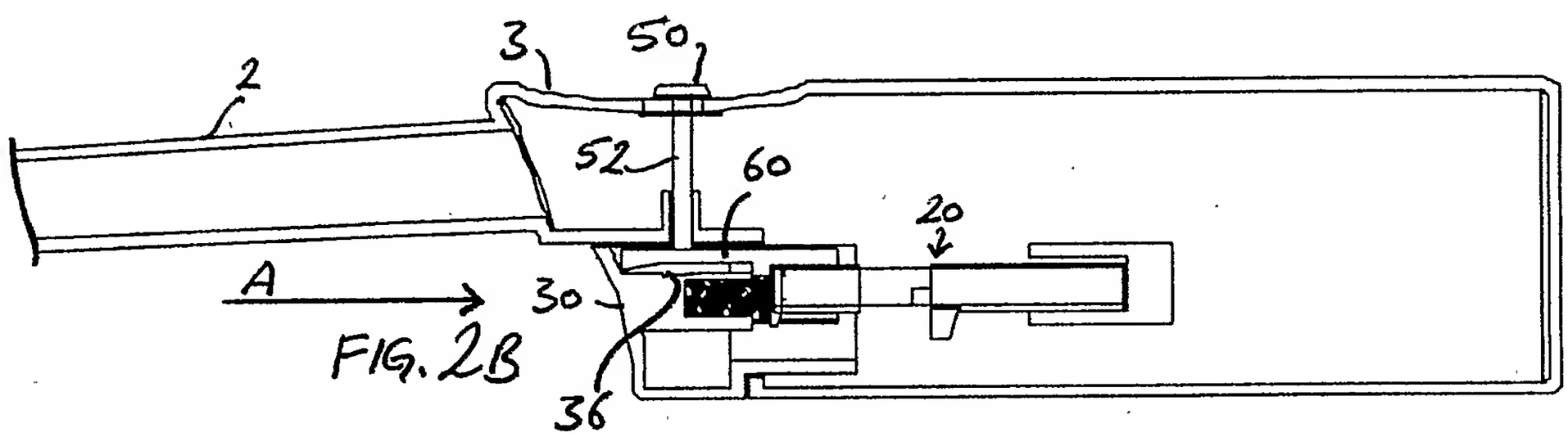

FIG. 2B

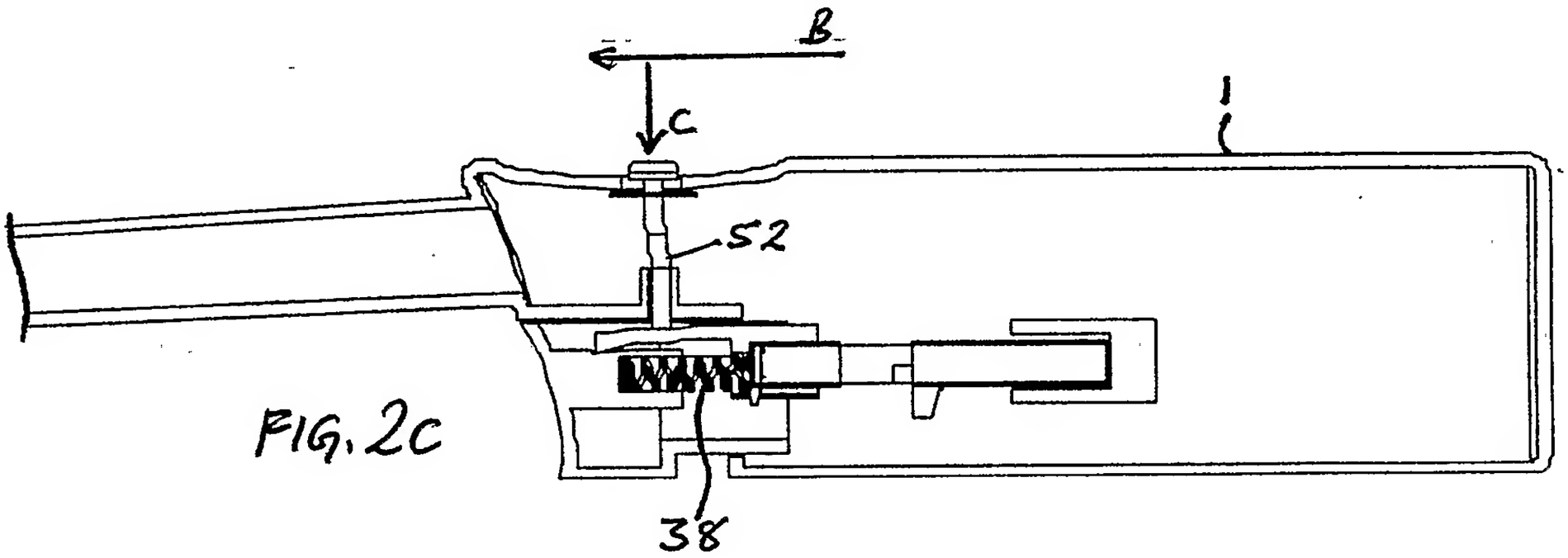

FIG. 2C

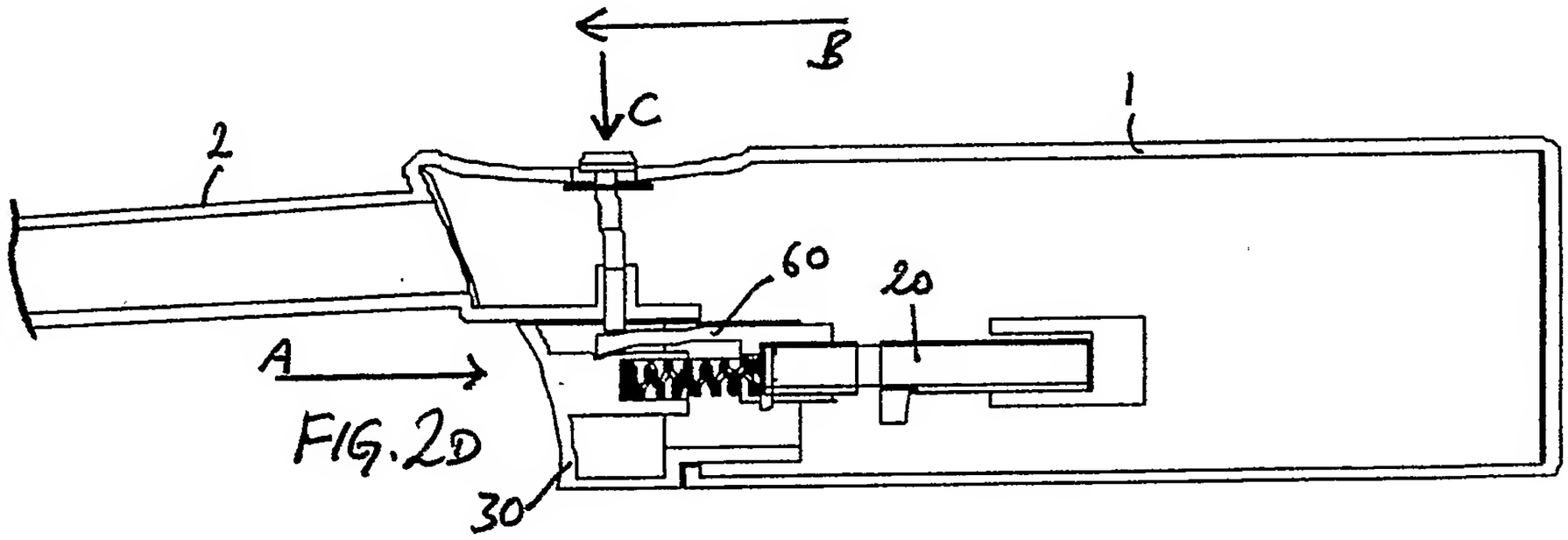

FIG. 2D

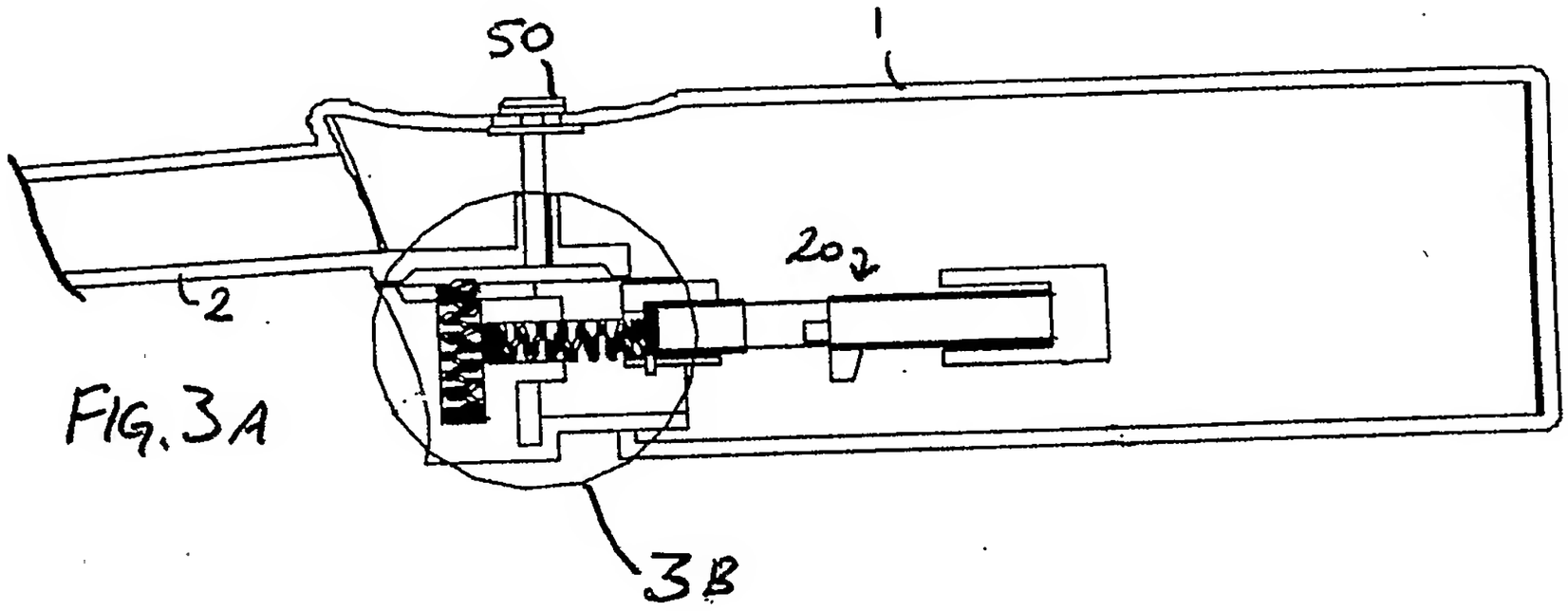

FIG. 3A

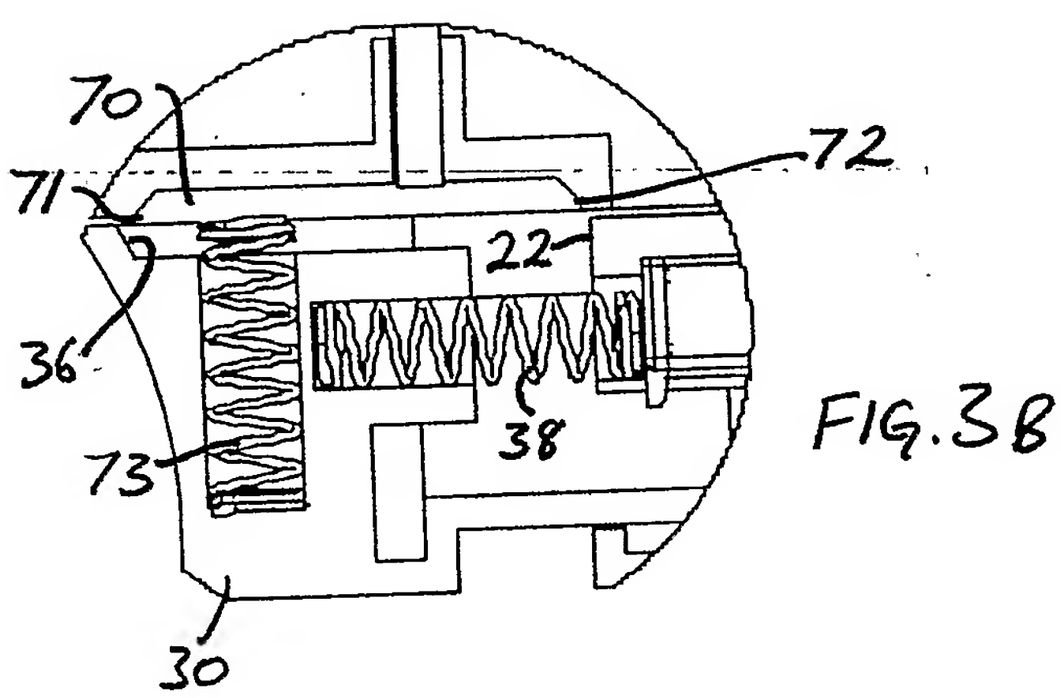

FIG. 3B

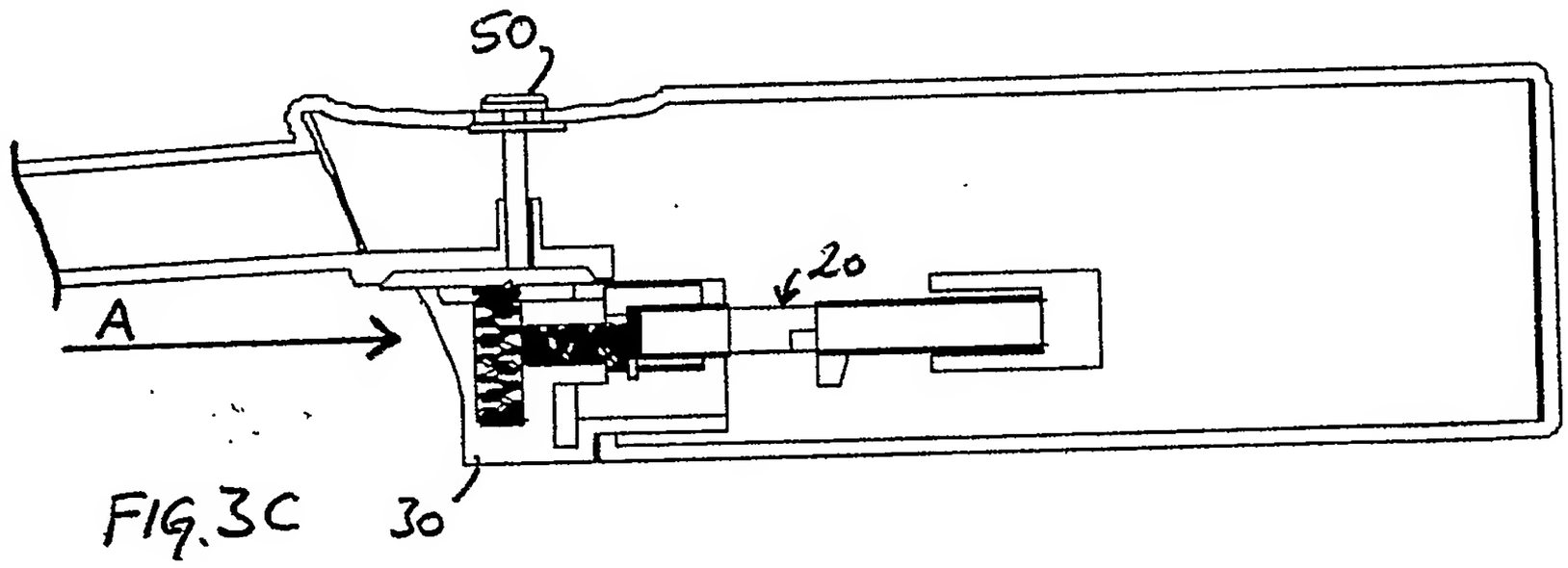

FIG. 3C

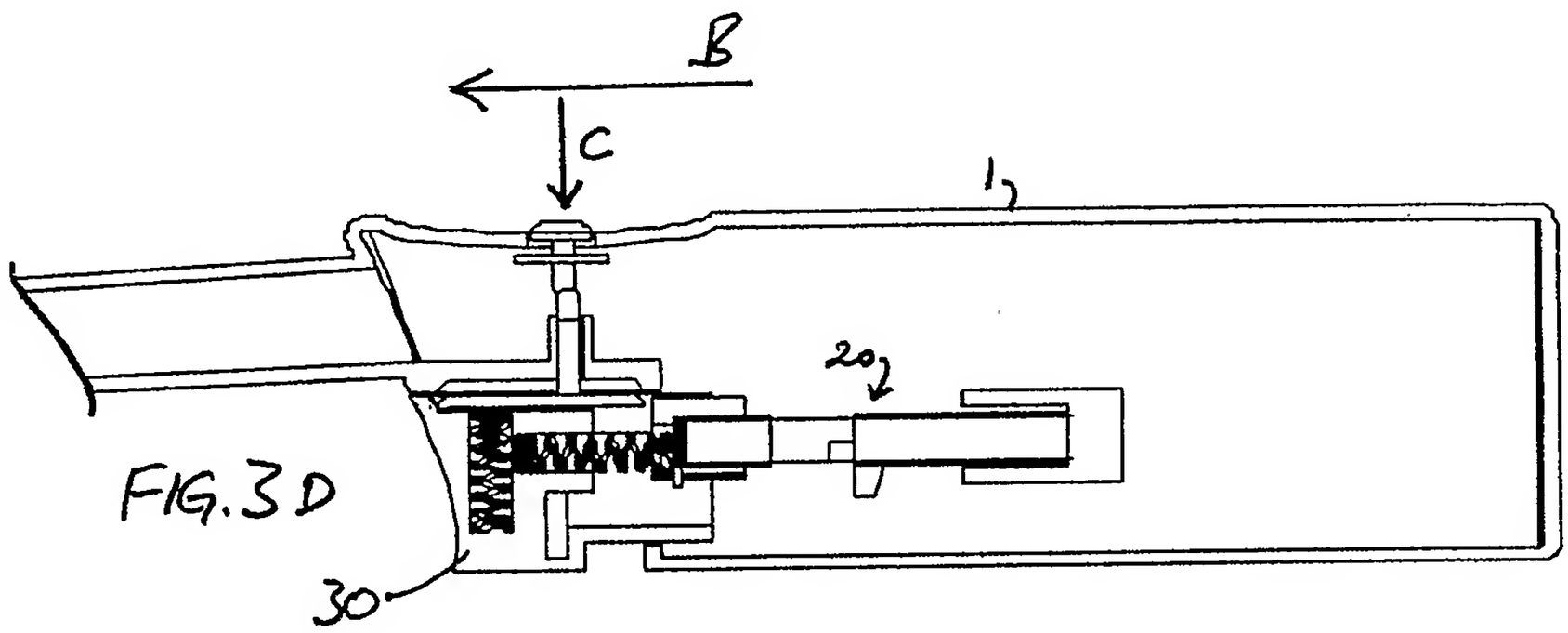

FIG. 3D

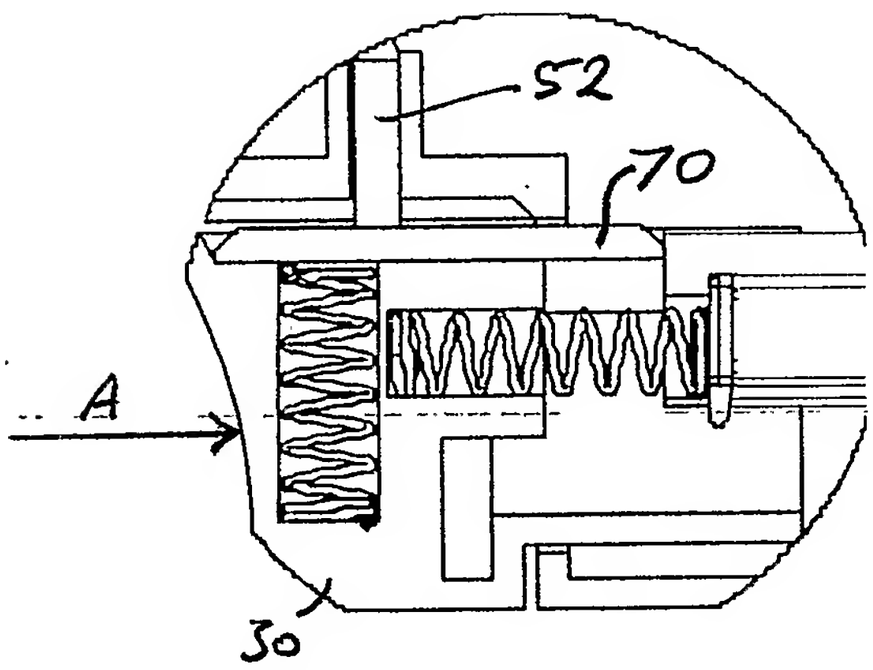

FIG. 3E

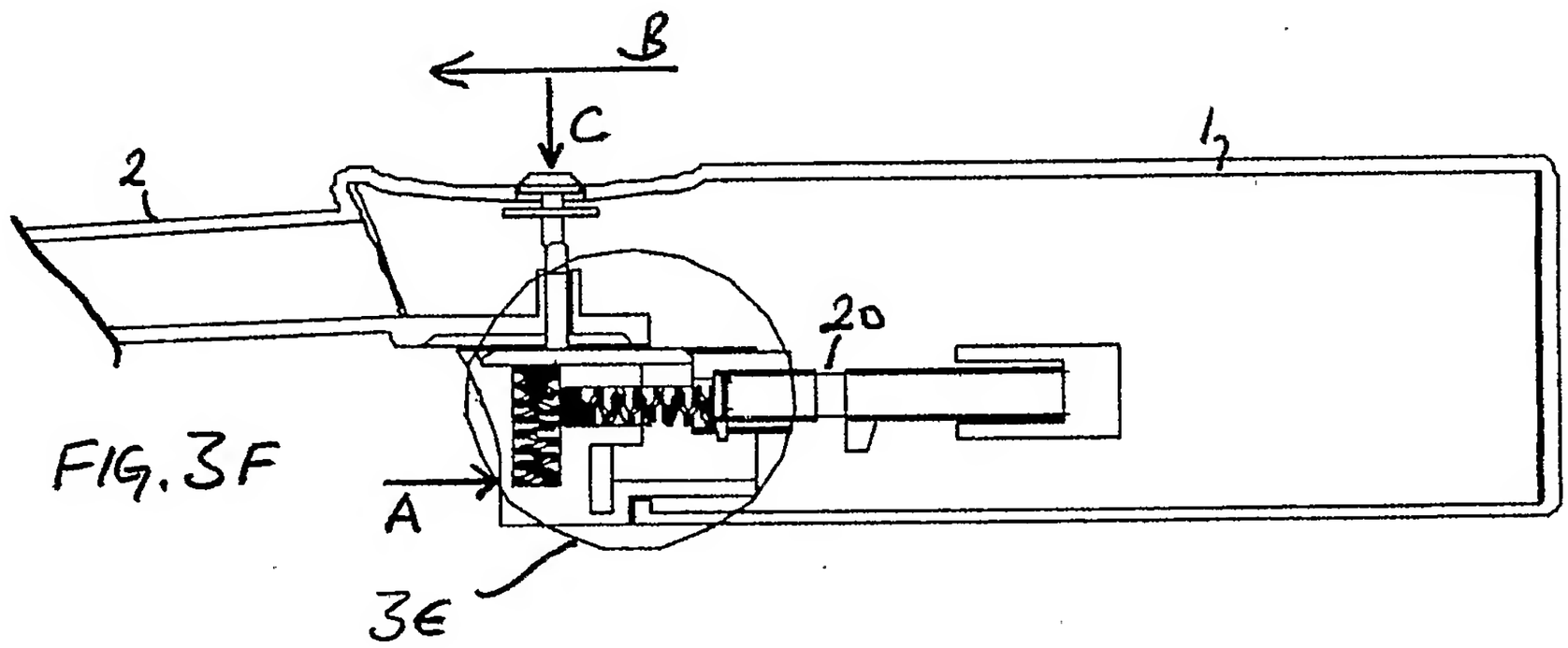

FIG. 3F

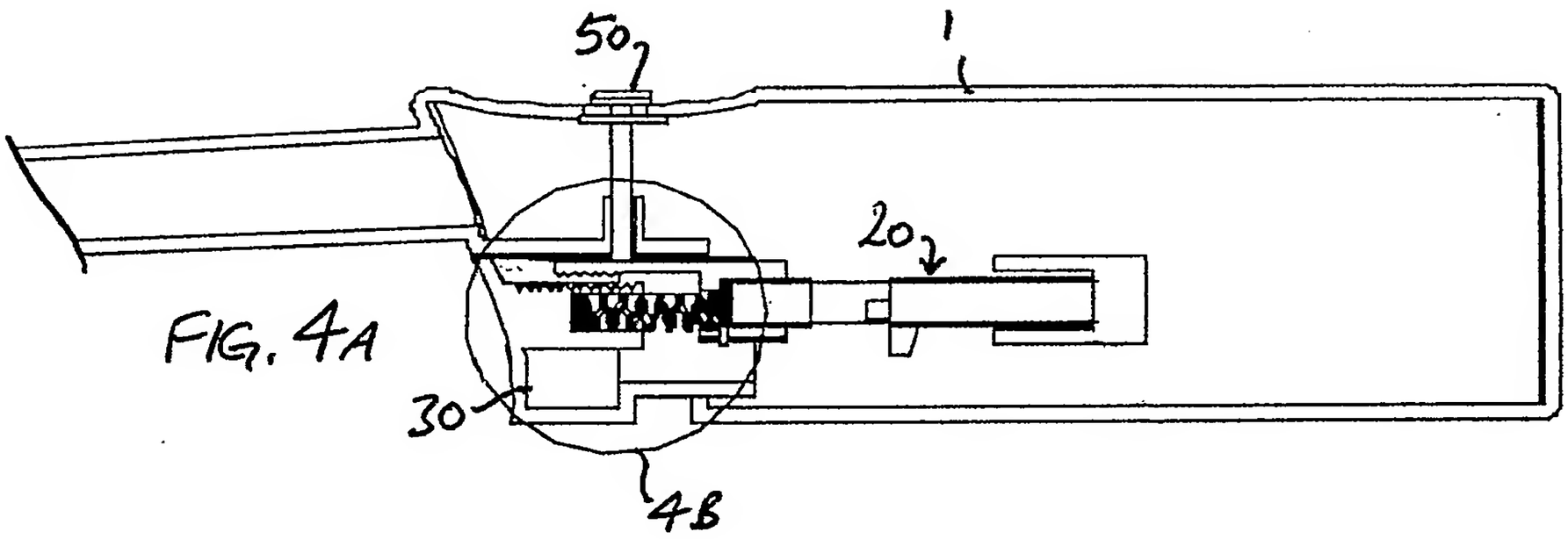

FIG. 4A

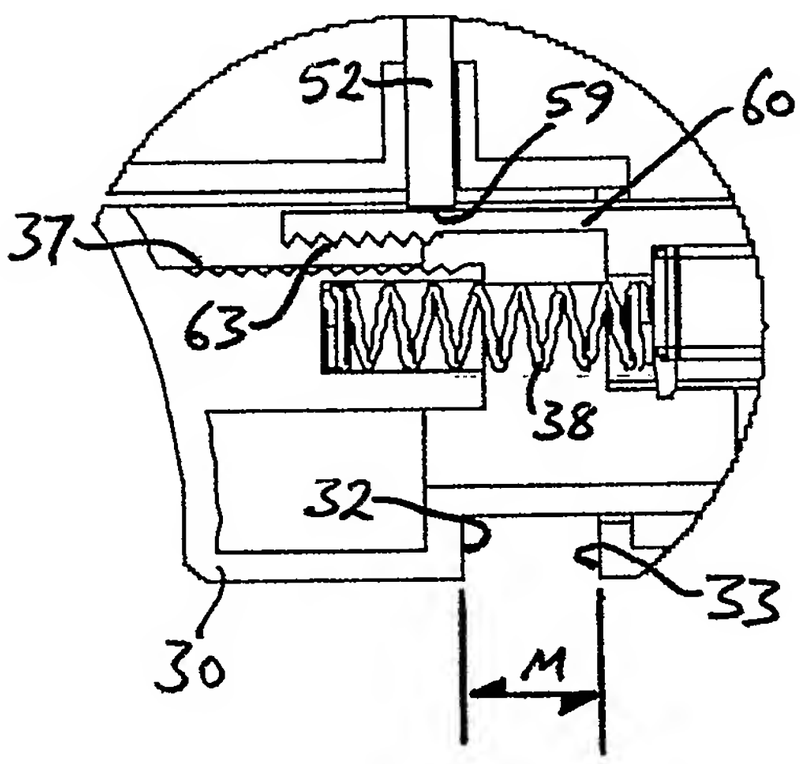

FIG. 4B

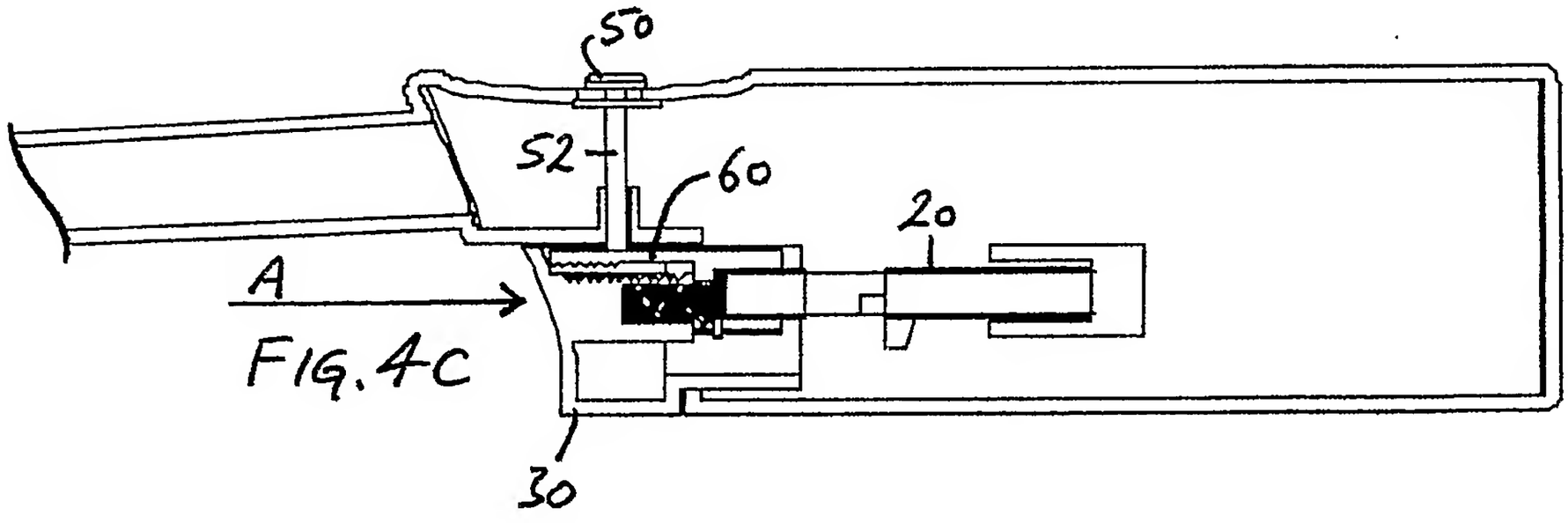

FIG. 4C

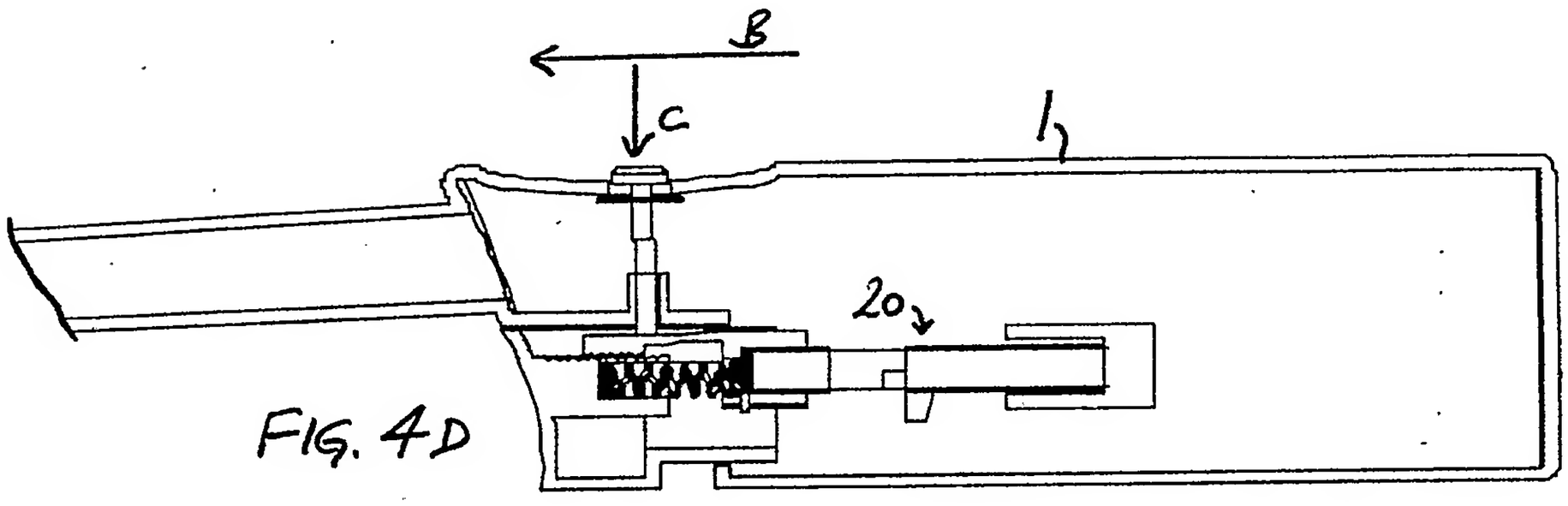

FIG. 4D

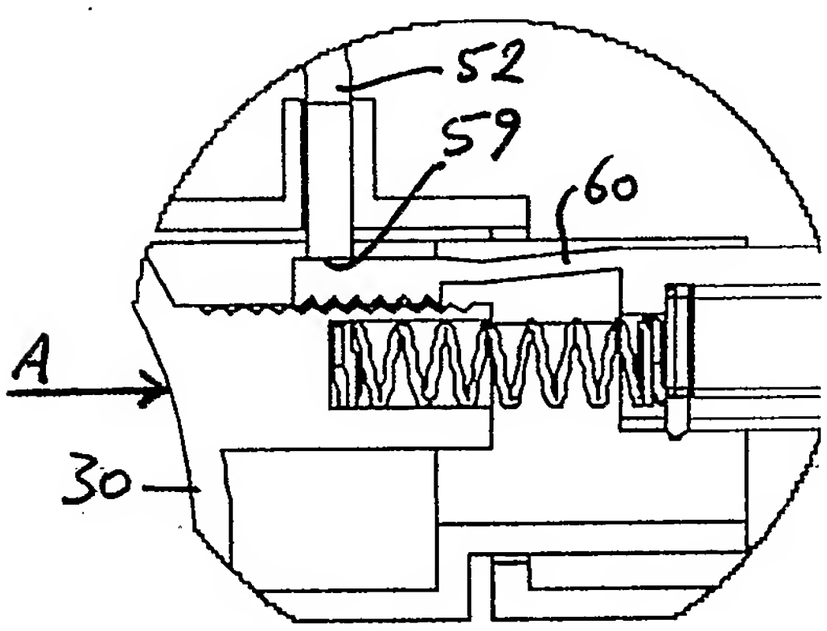

FIG. 4E

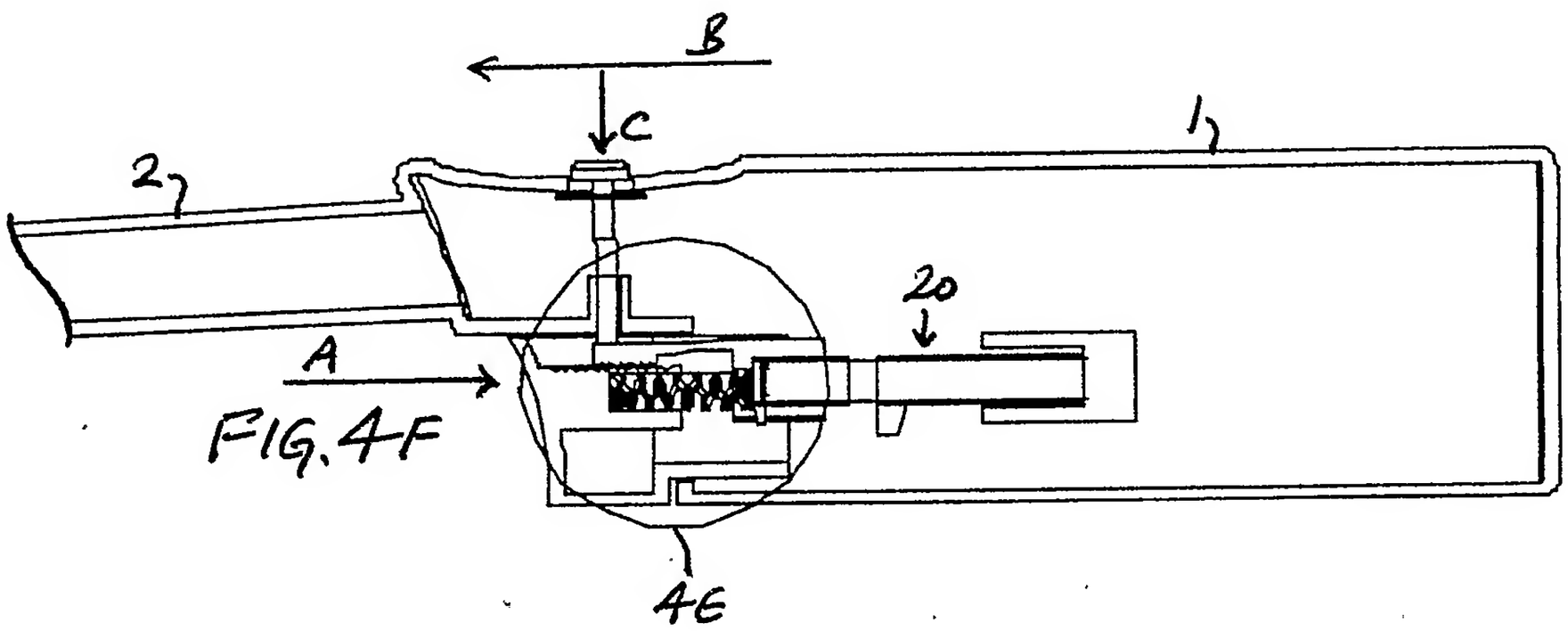

FIG. 4F

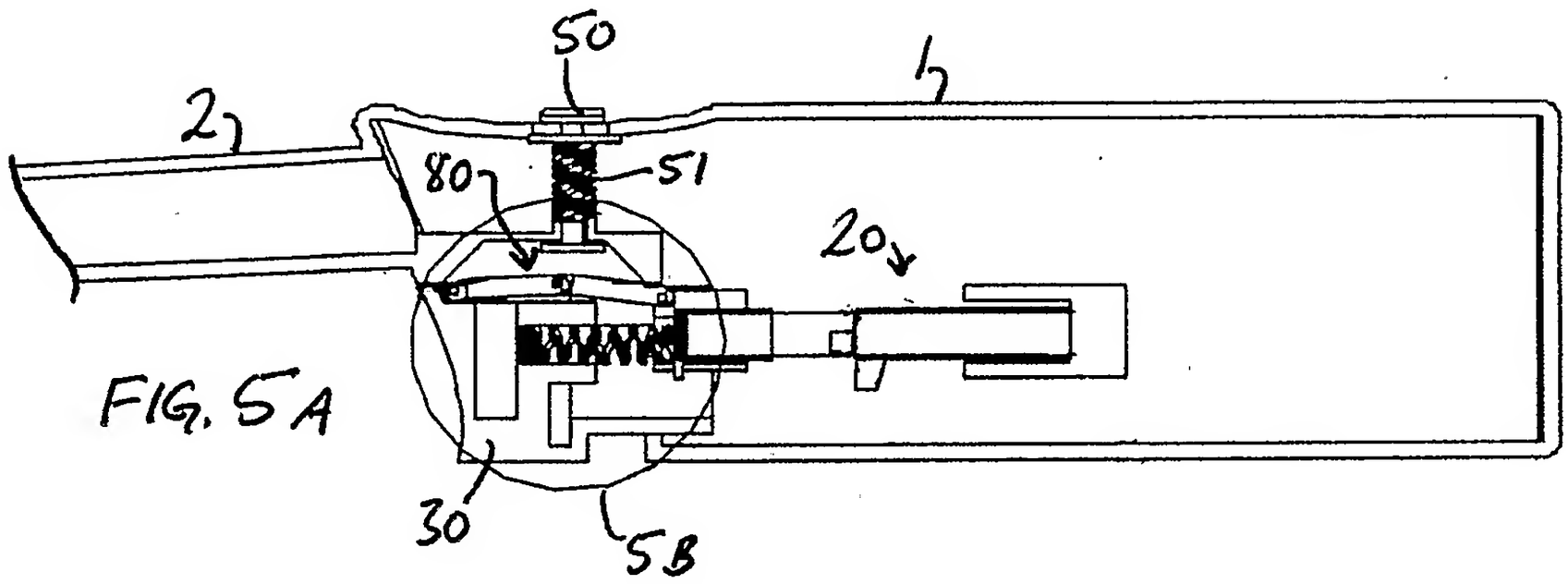

FIG. 5A

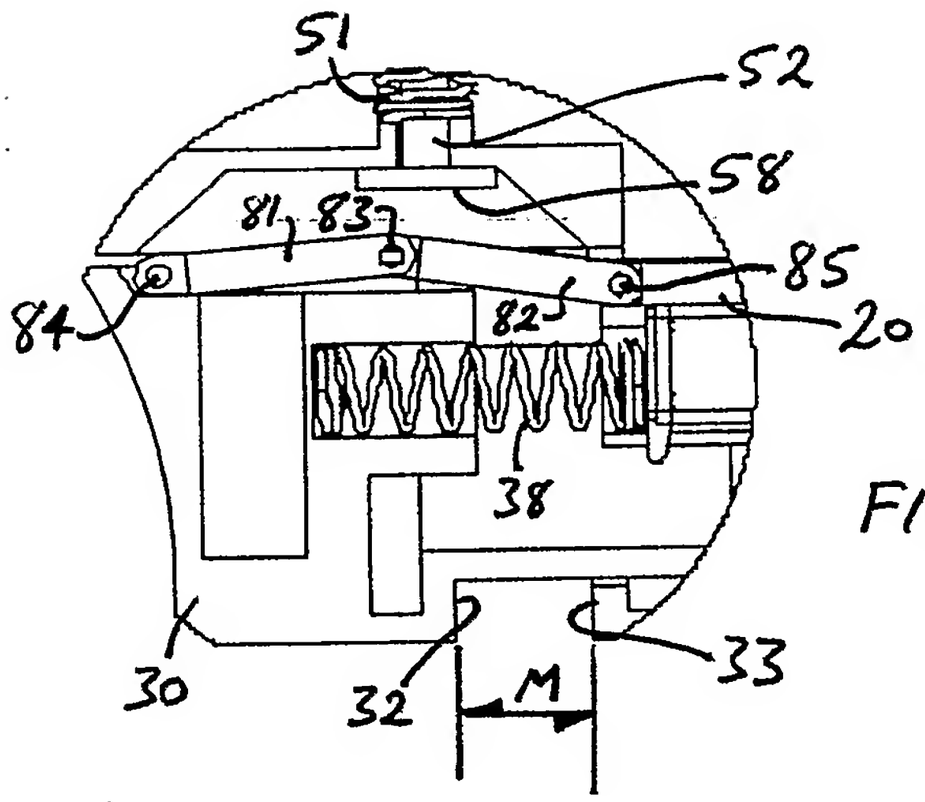

FIG. 5B

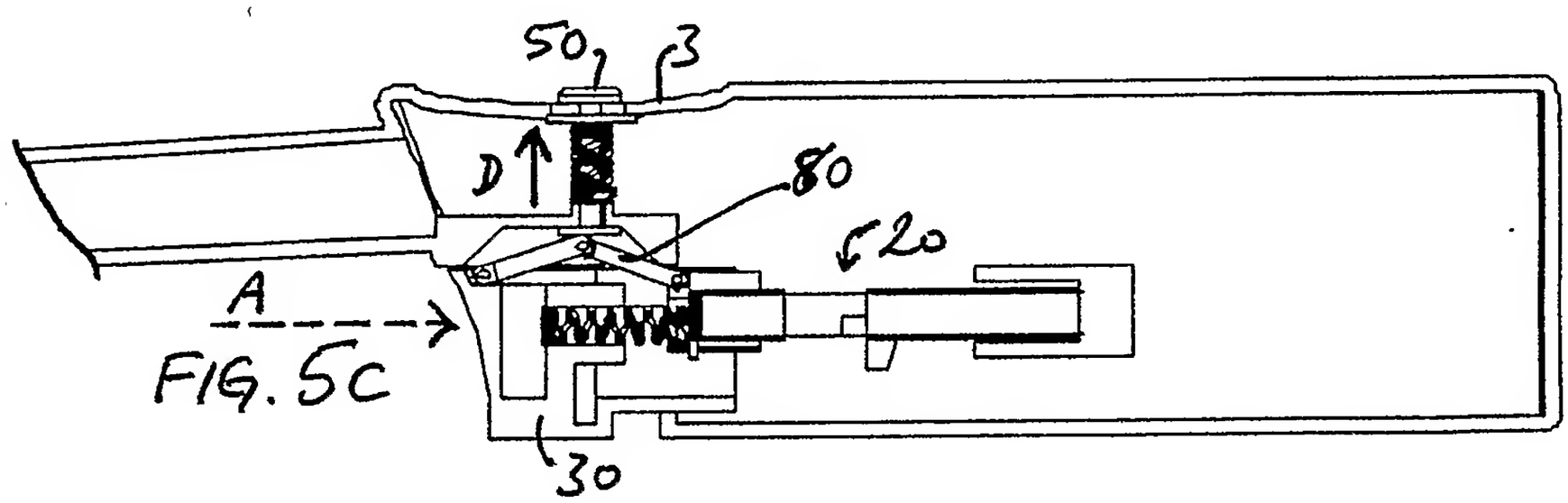

FIG. 5C

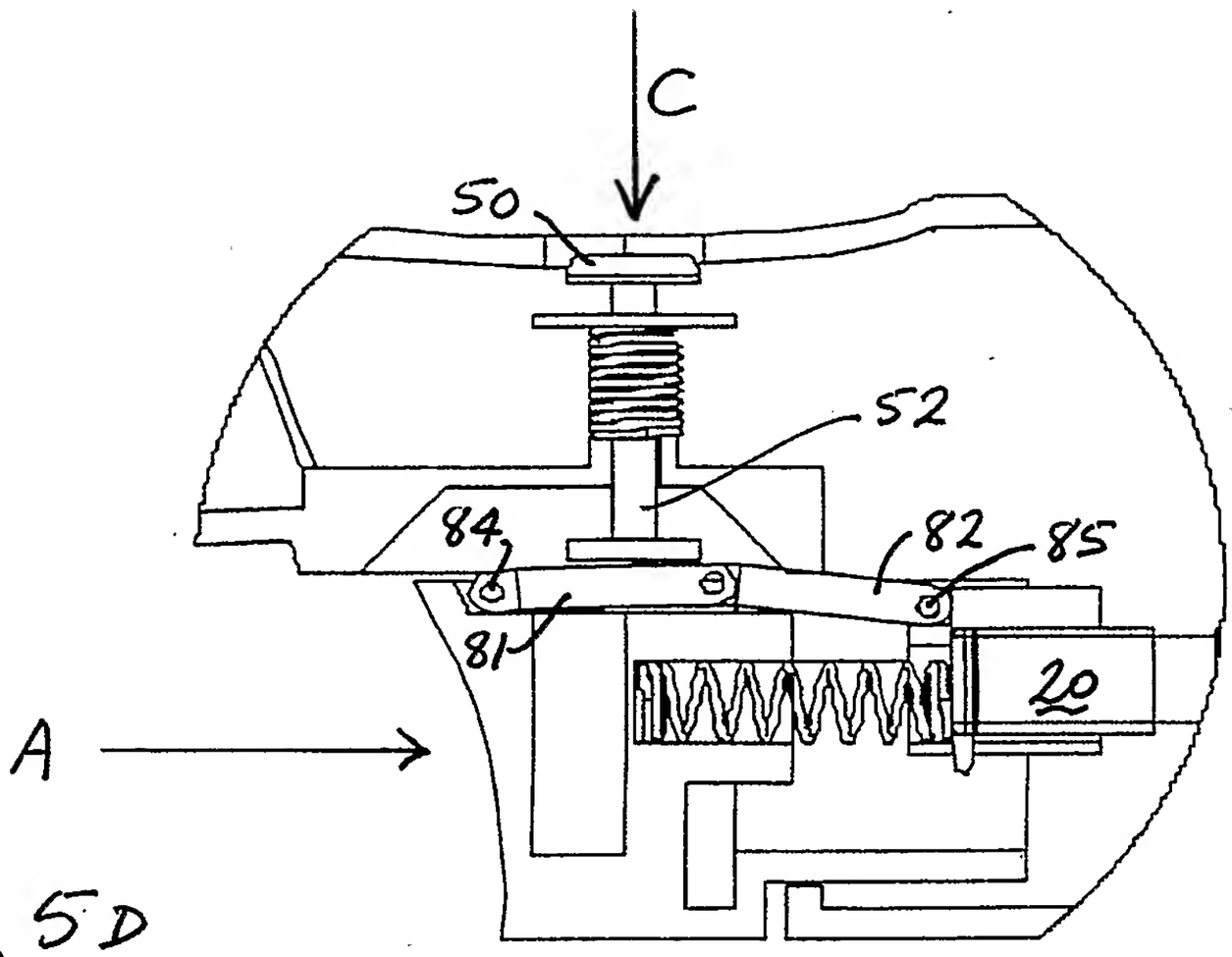

FIG. 5D

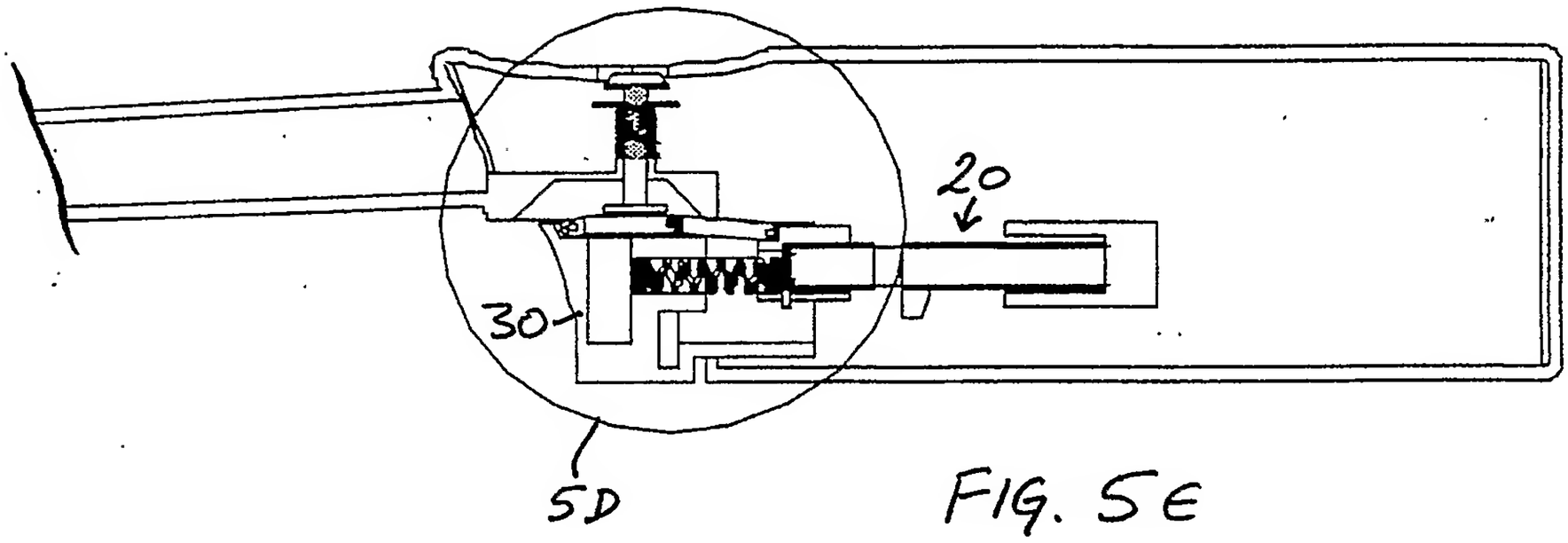

FIG. 5E

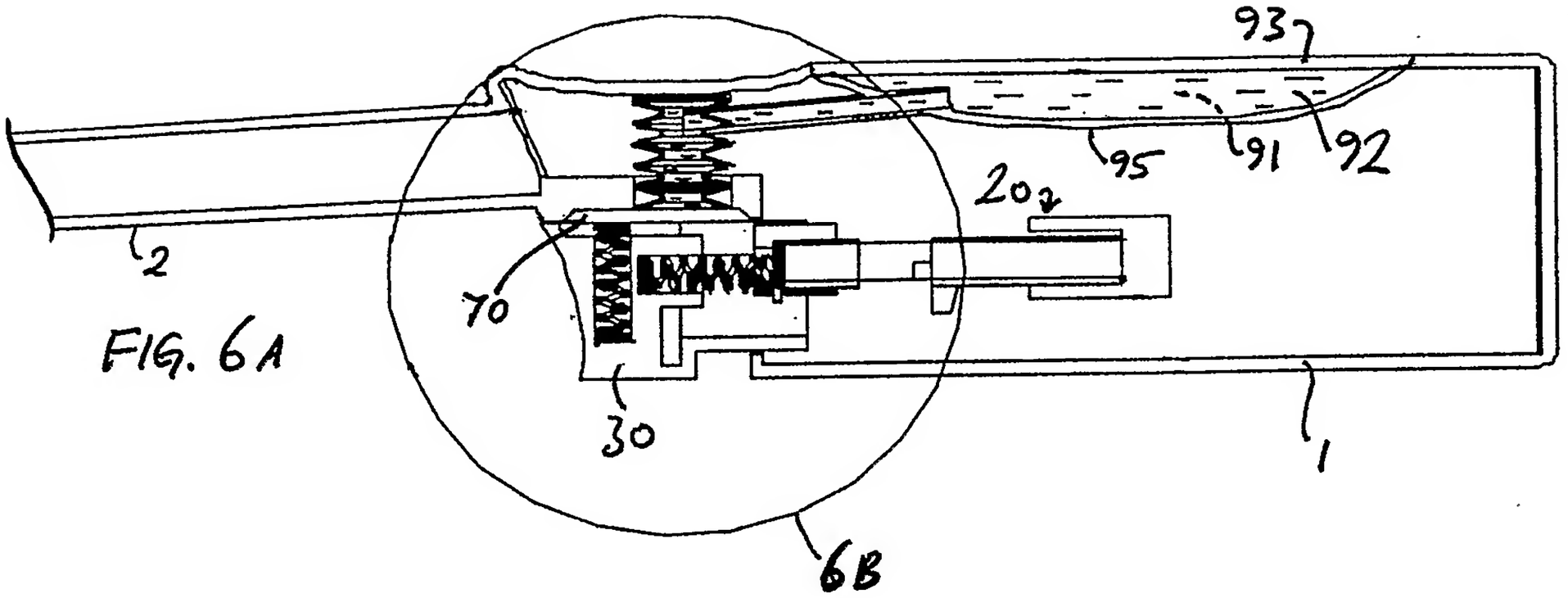

FIG. 6A

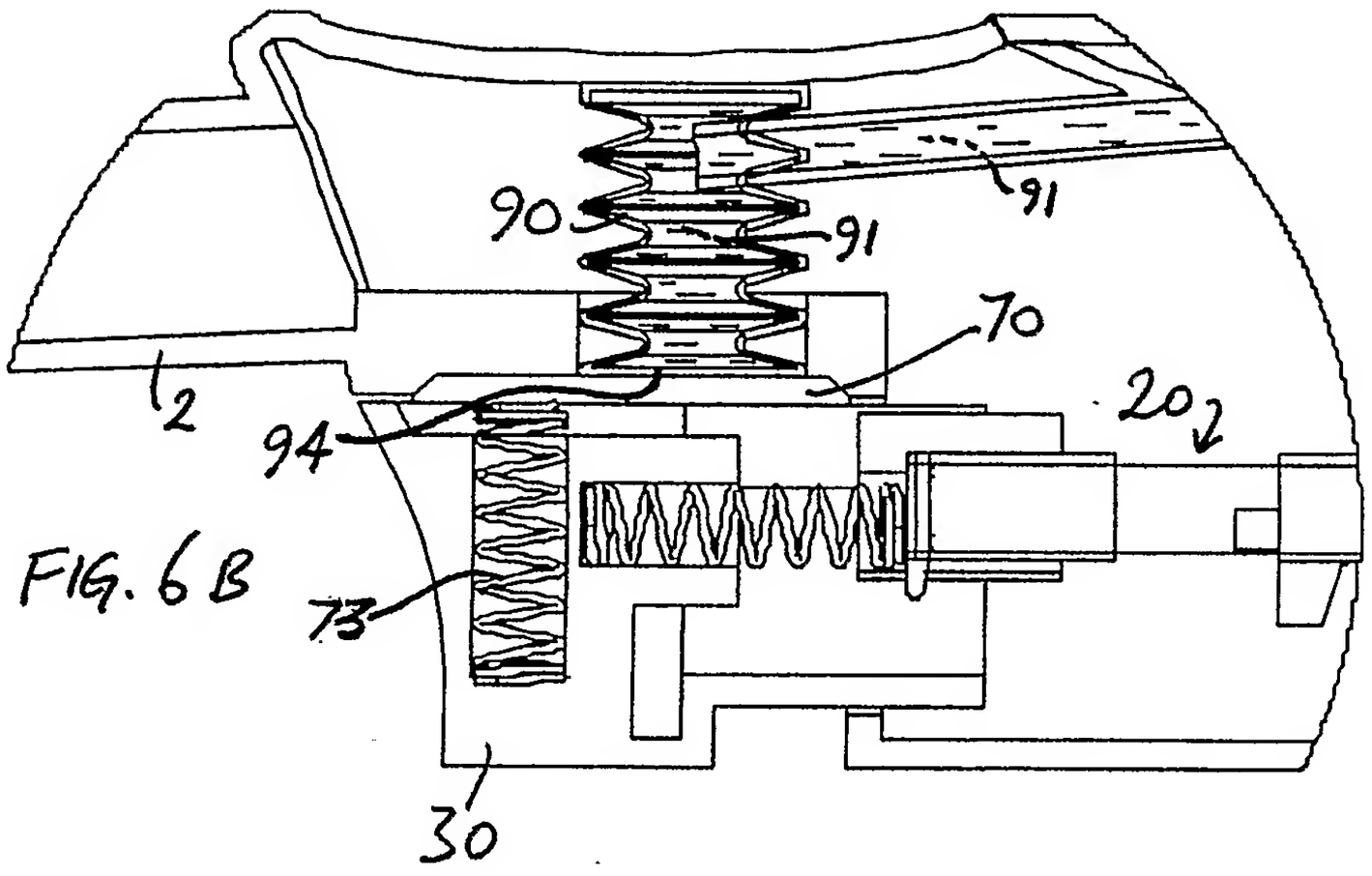

FIG. 6B